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EDITORIAL

IS CHEMISTRY DOOMED?

Many of the thousands of workers who are assiduously engaged amidst beakers and flasks, balances and burettes in chasing the very elusive alkaloids and the less elusive heavy metals, are not aware of the trend that threatens the individuality of their science. Coming events may cast their shadows before, but such shadows are seen by but few and sometimes by no one. Those who proclaim the coming storm are almost always regarded as Cassandras. For a goodly number of years, and of late with increasing vividness, it has seemed likely that chemistry will be absorbed into physics, as astronomy has been. An evolutionary movement may remain long unappreciated, and its direction and effects misunderstood. Concerning chemistry, the camel's nose was inserted in the tent about the middle of the last century when "chemical physics" began to appear as a section in text-books. The pioneers were essentially Pfeffer, Dutrochet and Graham. The first-named, a botanist, discovered the elementary facts about the transudation of different solutions through membranes, the second introduced the terms "endosmose" and "exosmose," and the last-named gave us the word "dialysis" and many additional facts concerning osmotic phenomena. Since the days of these investigators, an immense amount of data has been accumulated, notably in the fields of colloid chemistry and ionization, and the present-day text-books have a very different appearance from those in use fifty years ago. In the earlier ones an algebraic formula was scarcely, if ever, seen. A few examples in stoichiometry, employing simple proportion, made up the methematical allusions. Today higher algebra and calculus are much in evidence.

The old term "chemical physics" is no longer used. The data are all grouped as "physical chemistry," but the change by which chemistry became the noun instead of the qualifying adjective does not mark a dominance of that science, for as matter of fact, the great bulk of the data in physical chemistry is physical not chemical. There seems to be a possibility that before many years teaching chemistry will be only a department of physics. Even now it is often included in a "Department of Physical Sciences" in contrast with a "Department of Natural Sciences," which include Biology, Geology and some kindred topics.

The crisis is indicated by an article in the current number of *Scientia,* the international journal of synthetic science (published in Italy), entitled "The Steps of the Absorption of Chemistry by Physics," by Marcel Boll, of Paris. After an interesting review of some of the developments of physical chemistry, not including any reference to colloid phenomena, the author proceeds, as follows: "Among other philosophic influences, the new theories do not fail to modify the traditional ideas as to the domain of chemistry and its place among the other sciences. . . . It is often said that chemistry should occupy itself with setting forth the properties of substances, but a collection of facts, however numerous, does not constitute a science; what is termed 'descriptive chemistry' is merely a preparation for the science. Until late years, chemical action was defined as that which profoundly alters the properties of substances, but this definition is superficial and out-of-date. It makes the nature of phenomena subject to vague impressions of the senses, and neglects the reversible reactions, the theoretic significance of which cannot be overestimated. The profound transformations under the influence of radio-activity cannot be separated from physics. The distinction between chemical and physical phenomena is indefinite, because changes of state, solution and chemical reactions present close analogies, and form a quite homogeneous group, obeying common laws, which, for the most part, are dependent on thermodynamic principles."

The absorption is, however, according to our author, to go on, and chemistry will have its revenge by seeing the absorption of physics by mathematics, since Euclidian geometry and Newtonian mechanics are only approximations, sufficient for practical purposes. "The reduction of chemistry to physics is thus but one of the episodes of

present-day work, which leads irrevocably to the interpenetration of the sciences, fragmentary when first developed and necessarily confined within artificial limits."

In the analytical laboratory the invasion of physics has been for some years quite evident. Apparatus substantially physical, such as refractometers, polarimeters, electrolytic measuring instruments, microscopes with many accessories are now part of the necessary equipment of the ordinary commercial installation. In earlier days, the student who left college to take up chemical work could afford to forget all about logarithms, but the importance of hydrogen-ion concentration has brought back such problems into the midst of the beakers and balances. The probability is that before many years the chemistry, as profession for the solution of problems in industries, sanitation, toxicology and such subjects, will be differentiated markedly from the research work, especially in biology and physical chemistry, and the workers in each field will pursue their occupations with more or less independent spirit.

H. L.

SELECTED EDITORIAL

NAMING THE BRAIN-CHILD.

From Science Service.

When a man makes a new invention or unearths a new medicine his work is not done. He should invent a new name for it. Here he is apt to fail, for, being more of a mechanic than a philologist, he turns over the job to the Greek professor who manufactures one out of old roots. So it happens that many a handy little pocket tool or a potent little pill is handicapped by a name that wraps three times around the tongue. But the people refuse to stand for it.

Consider what a Babel-like botch has been made of the job of naming the new art of photographing action. Rival inventors, rival word-wrights, and rival systems of Greek transliteration precipitated a war of words in which the chief belligerents were animatograph, animatoscope, biograph, bioscope, chronophotography, cinema, cinematograph, cinematoscope, cineograph, cineo-

scope, electrograph, electroscope, kinema, kinemacolor, kinematograph, kinematoscope, kineograph, kineoscope, kinetescope, motion pictures, moving pictures, photo plays, tachyscope, veriscope, vitagraph, vitascope, zootrope, zoogyrograph, zoogyroscope and zoopraxiscope.

But the people—they call it "the movies." It is not a great name, but it is better than some at least of those listed above.

If, instead of trying to load the new machine with a name implying that it had been invented in Athens or Rome, its godfathers had given it a respectable, convenient name of one or two syllables like "kodak," "volt," "velox," or "viscose" much of this confusion might have been saved. Think how many millions of dollars, years of time, barrels of ink and cubic miles of hot air would have been saved if "electricity" had been named in one syllable instead of five. We might even now cut it down to "el" except that by popular vote the six syllables of "elevated railroad" has been reduced to that handy term. So, too, the people have found a way to reduce "radiotelephony" to a single mouthful, "radio," and the druggist round the corner finds it much easier to say cinchophen in preference to phenyl cinchoninic acid.

The lesson of it is that if the father of a new invention or a new drug does not want to have his child called by a nickname let him give it a short and snappy name on the start.

E. E. S.

ORIGINAL PAPERS

ANATOMICAL AND CHEMICAL STUDIES OF THE SAND SPUR (CENCHRUS TRIBULOIDES L.).*

By Heber W. Youngken and Charles H. La Wall.
Philadelphia College of Pharmacy and Science.

The early history of *Cenchrus tribuloides*, commonly known as Sand Spur or Sand Bur, and also known by the synonyms of Bur Grass or Hedgehog Grass, the spiny burs of which have caused painful wounds in man and the lower animals, appears to be somewhat obscure. That this plant was known to the pre-Linnean botanists is evidenced by the statements of representative authors of that period. Thus Moris [1] figures a plant which is identical with *Cenchrus tribuloides L.* and describes it in the phrase: *"Gramen echinatum, spicatum locuster crassioribus tribuloidibus Virginianum."*

Plukenet [2] in his "Phytographia" lists the plant under the title of *"Gramen tribuloides spicatum maximum virginianum."*

To Linnæus,[3] however, belongs the credit of naming the plant as it is known to most botanists of today. In his "Species Plantarum" of 1753 he listed it under the *"Polygamia Monœcia"* and described it as *"Cenchrus glumis femeneis globosis muricate spinosis hirsutis,"* and mentioned its habitat as Virginia near the sea.

Muhlenberg,[4] a clergyman and early American botanist, lists it in his "Catalogue of Plants of Lancaster, Pa., and Vicinity" under Class III, Triandria Monogynia, and states that it is a wooly, spiked annual with one subrotund seed and having a two-valved calyx, two-valved corolla and a two-flowered involucre. He appears to be the first to name it Sand Spur, Hedgehog Grass or Sand Bur.

In 1814 Frederick Pursh,[5] in "Flora Americæ Septentrionalis," gave its distribution as near the seashore from New Jersey to Florida and described it as *"Cenchrus spica spiculis alternis, glumis femineis globosis muricato spinosis hirsutis."*

In 1824, Torrey,[6] in "Flora of the Northern and Middle Sections of the United States," described it as follows: "Culm a foot to one and a half feet high, compressed, smooth. Leaves linear, lanceolate, conduplicate, a little roughened above. Sheaths dilated open. Racemes ten to fourteen flowered; rachis angular, hairy. Involucrum

*Read before the 1922 Meeting of the Pennsylvania Pharmaceutical Association.

split on one side, hairy, including two spikelets, each one to two flowered." He stated its distribution to be on the sea coast and near the mouths of rivers.

It appears that few lay citizens of the United States made the acquaintance of Sand Spurs until the battle of Palo Alto, during

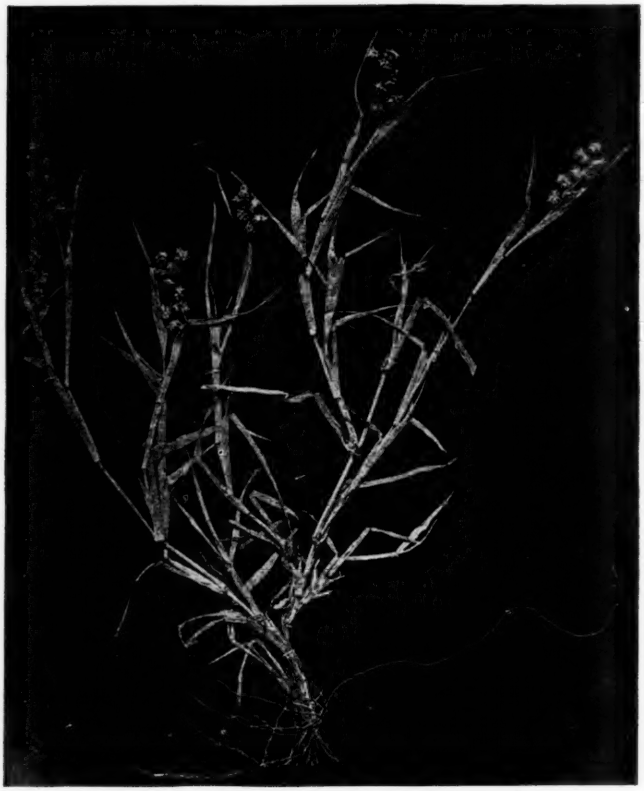

Fig. 1. *Cenchrus tribuloides* L. x 1/8.

the Mexican War, when, according to Meehan,[7] they were quite as annoying to our soldiers as the bullets of the Mexicans. The burlike fruits attached themselves to the soldiers' clothing and in this way the plant became widely distributed after the Mexican War.

Chapman,[8] in his "Flora of the Southern States," published in 1860, gives the synonym of Cock-spur for Cenchrus and describes *Cenchrus tribuloides* as follows: "Involucres whitish, ten to fifteen in a spike, wedge-shaped at the base, armed above with stout, com-

pressed, broadly subulate, erect or spreading spines; bristles none; spikelets mostly in pairs. Sands along the coast, Florida and northward. July-October. Annual, with prostrate culms, one to two feet long. Leaves linear. Spikes one to two feet long."

Apparently no work was published on the histology of this plant until Gayle,[9] in 1892, briefly described and figured the lower portions of the spines of the fruit. He states that the spines are barbed, that each barb has within it a cavity terminating in the direction of the point, in a narrow tube and to be filled with a substance which has a light purple color. He adds that in all probability this substance is of a highly irritating nature and may be assumed to be the direct cause of the inflammation of the wound. He figures and describes large air spaces in the spines.

In Gray's "New Manual of Botany," revised by Robinson and Fernald,[10] the synonyms Sandbur and Bur Grass are given the genus Cenchrus and the following description of *Cenchrus tribuloides* L.: "Culms more robust (than *C. carolinianus*), often extensively branching or trailing, three to nine dm. long; sheaths loose, usually hirsute along the margins, ligule conspicuously ciliate; blades more or less involute; racemes usually included at the base; involucres twelve to fourteen mm. thick, densely long pubescent; the stout spines spreading or ascending. Sands along the coast, New Jersey and southward."

Britton and Brown,[11] in second edition of their "Illustrated Flora of the Northern United States, Canada and the British Possessions," published in 1913, state that the plant is found in sand along the coast from Long Island and New Jersey to Florida and Mississippi. The same authors briefly describe the plant and give as its synonyms, Bear-Grass, Bur-Grass, Sand-spur and Sand-bur.

In 1920, Hitchcock and Chase,[12] in their "Revision of the North American Grasses," carefully described and figured the external features of the plant and its fruit. They consider the inflorescence as a contracted panicle with short, fascicled branches, these disarticulating from the main axis and all but a few being sterile. According to these authors the body of the bur represents the cup-shaped or globose part which is found to be formed by the coalesced part of the branchlets from which the free ends extend. The lobes are considered as the free ends of the innermost ring of branchlets which form the body. The same authors give the distribution of the plant as in loose sands of the coast from Staten Island, N. Y., to

Florida and Louisiana, on the Atlantic Coast of Costa Rica, in the West Indies and on the coast of Brazil.

The writers of this paper became interested in the subject while working on a sample of Sand Spurs with the purpose of ascertaining whether any constituent of the hairs or barbs was responsible for the inflammation which in many instances follows wounds induced by their spines.

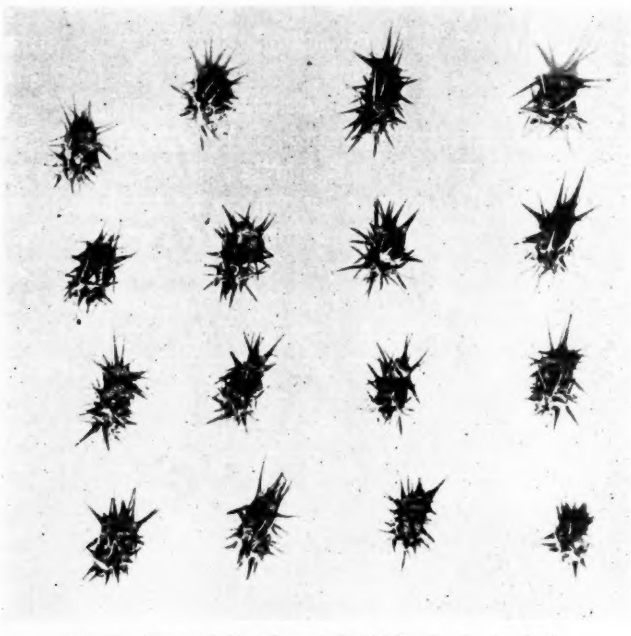

Fig. 2. Burs of *Cenchrus tribuloides* L. (nat. size).

The materials used were abundant dried burs (obtained from Florida) in varying stages of maturity as well as herbarium sheets of *Cenchrus tribuloides* from the Martindale and College herbaria. The anatomical and micro-chemic portions of the work were carried out by Dr. Youngken, while Dr. La Wall investigated the chemistry of the mature burs with contained fruits. Observations on the growth habits of this plant were made by both the writers along the coast of New Jersey.

Description of Cenchrus tribuloides L.

Cenchrus tribuloides Linnæus (Fig. 1), commonly known as Sand Spur, Sand Bur, Coast or Hedge-Hog Grass, is an annual weed

belonging to the Grass family and found growing in sand dunes near the coast and along the beach from Long Island, N. Y., to Florida, Louisiana and Texas, on the Atlantic coast of Costa Rica, along the coast of the West Indies and of Brazil. From a subterranean fibrous root system arise several culms, which soon branch and grow out in radiate fashion, attaining a length of up to 60 cm. Each of these is decumbent and takes root at its nodes, from whence also arise several ascending branches that may attain a length of 25 to 31 cm. The leaves are alternate, exstipulate, each exhibiting an overlapping sheath, a lamina and a ligule. The sheath is keeled, pubescent along the margin and at its summit and exhibits a dense tuft of hairs. The blade is flat and linear-lanceolate, scabrous on upper surface, with more or less involute margin, up to 18 cm. in length and up to 7 mm. in breadth at the base.

The inflorescence consists of a raceme or spikelets borne along a zigzag rachis and enclosed singly or in pairs within a spiny, subglobular, pubescent involucre, 12 to 14 mm. thick, which, upon maturity, forms a deciduous, hard, rigid bur (Fig. 2), with stout, broadly subulate barbed spines. Each burlike involucre contains one or two awnless spikelets. When these are examined separately under a dissecting lens they show from without inward the following parts: (1) a hyaline scale, (2) two membranous scales, (3) a palet surrounding a staminate flower, (4) a papery scale subtending (5) palet of a perfect flower, and (6) a perfect flower with a unilocular, acuminate-ended pistil that terminates in two short plumose styles. The fruit is a pyriform caryopsis (Fig. 8), terminating in two short styles and containing an albuminous seed. One to two of these fruits occur free within the scales of the spikelet or spikelets of each spiny bur. When mature the burs separate readily from the rachis and fall to the ground. They are well adapted for distribution through the agency of man and fur-bearing animals because of their sharp, rigid and barbed spines which stick to the clothing or fur coat. Frequently the spines penetrate the skin and flesh of exposed surfaces, particularly the feet of non-vigilant bathers and cause distressing pain and inflammation. They are difficult to extricate when forced into the skin even half of their length. This is due to the presence of sharp, retrorse barbs extending backward from the tip half the length of the spine. In attempting to remove the spine the flesh is torn by the barbs and the wound made larger.

Histology of the Burs.

The burs of *Cenchrus tribuloides L.* possess a somewhat rounded polygonal outline, when observed in transverse sections, and exhibit numerous outgrowths in the form of long, flattened, attenuated spines (Fig. 2). They, therefore, present for examination interspinal regions and spines. Excluding the hairs, the interspinal regions of

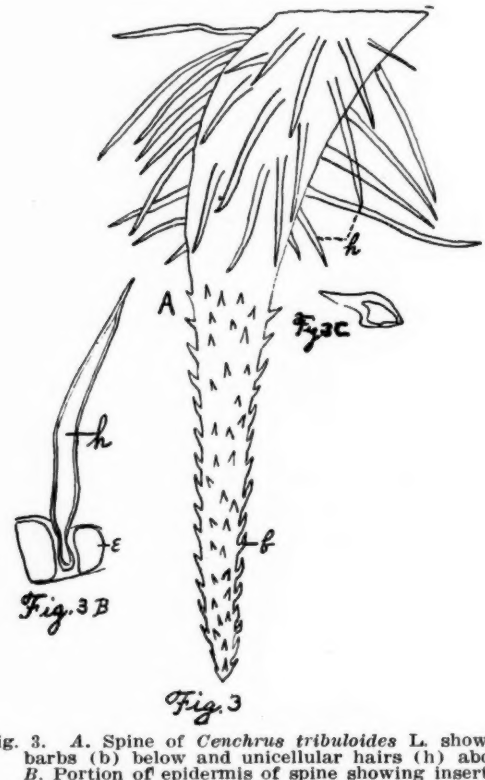

Fig. 3. *A*. Spine of *Cenchrus tribuloides* L. showing barbs (b) below and unicellular hairs (h) above. *B*. Portion of epidermis of spine showing insertion of hair (h) between epidermal cells (e). *C*. Barb enlarged.

burs, containing good fruits, averaged 245 μ in diameter. They exhibit externally a colorless epidermis composed of a layer of clear, vertically elongated, epidermal cells with a thick cuticle and granular contents. Here and there between many cells of the epidermis are inserted the bases of unicellular non-glandular hairs. These hairs tend to show all transitions of development and while for the greater part are inserted far down, on the level with the

inner walls of the epidermal cells, nevertheless, may be found at varying levels. The tendency for the insertion to be higher is strikingly seen as the bases of spines are approached. There hairs may attain a length of 800 μ or more. They are usually slightly curved, tend to become more or less constricted near the base and terminate in sharp, straight or slightly curved ends. Each hair possesses a cellulose wall with a colorless outer cuticle and contains protoplasmic contents or air depending upon its age.

On the inner surface of the interspinal regions is to be noted a layer of clear, colorless, inner epidermal cells, possessing hairs somewhat similar to those of the outer epidermis but averagely shorter.

Between outer and inner epidermis is to be observed a broad mesocarp composed for the greater part of sclerenchyma fibers with thick, lignified walls. Coursing through this region are isolated, closed, collateral bundles.

The spines originate early in the development of the bur as outgrowths of its tissues. In their young condition they are often purplish-red or bluish, but gradually lose this color and become yellowish-brown.

They are for the most part flattened, conical in shape, with sharp attenuated distal ends. They are clothed with hairs (Fig. 3h) in their proximate third and exhibit sharp, recurved barbs (Fig. 3b) for the remainder of their length.

Transverse sections made progressively through the spines at varying distances from base toward the summit show an irregularly elliptical outline until the tip region is reached, where the outline is circular. (See Fig. 4.)

Each spine shows an outer epidermis investing a core of sclerenchyma fibers pervaded by fibro-vascular strands from the involucral-bur. The epidermis consists of long cells and short cells. As observed in transverse section, the long cells are rectangular, with thickened outer cuticle; in surface view they are rather narrow, elongated, pitted elements with wavy, vertical walls. Between the long cells at their ends are the short cells. They are found either singly as silica cells with a rounded lumen and silica content, or else in pairs known as twin cells, one of these cells being larger and occasionally clasping the other cell. The epidermal cells are largest at the base of the spine and become gradually smaller toward the tip. In about the lower two-thirds of the spine are to be noted sharp-pointed, re-

curved barbs (Fig. 3b), while in the upper portion unicellular, non-glandular, sharp-pointed hairs are visible (Fig. 3h).

The barbs readily break at their tips when pressure is applied to them.

The purplish-red to blue color of parts of the younger spines is found to be due to anthocyanins present in the cell sap of certain epidermal cells, sclerenchyma fibers and barbs.

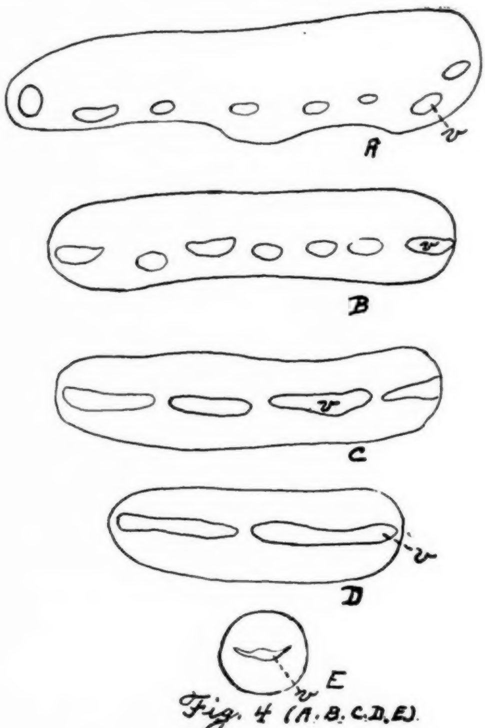

Fig. 4 (A. B. C. D. E.). Diagrams of cross-sections through several successive regions of the spines of *Cenchrus tribuloides* L. showing the outline of spines at successive levels as well as the gradual union of the vascular strands (v) in passing from base to tip.

Surface and longitudinal sections of younger spines showing purple and blue-colored cell sap in these elements were examined microchemically. The results were as follows: When thin sections were placed in a 10 per cent. alcoholic solution of ferric chloride the originally purple or blue cell sap became red in about a minute. When to this concentrated hydrochloric acid was added the color

disappeared in a short time. When other similar sections with cell sap originally purple to blue were mounted in a 1:5 solution of silver nitrate and gently warmed, the purple and blue contents became black. These tests would tend to show that formates may be present in certain cells of the epidermis, as well as in a number of sclerenchyma fibers and barbs of younger spines.

Surface and longitudinal sections of mature spines show the elements to be entirely devoid of the purple and blue cell sap contents noted in the case of younger spines.

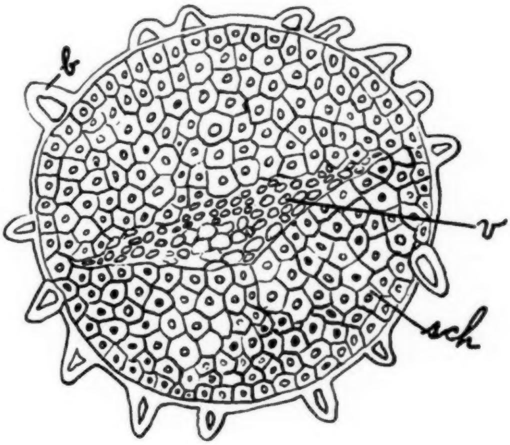

Fig. 5

Fig. 6

Fig. 5. Transverse section through the spine of *Cenchrus tribuloides* L. near its termination showing barbs (b), sclerenchyma fibers (sch) and vascular tissue (v), (greatly magnified).

Fig. 6. Fruit of *Cenchrus tribuloides* L. invested by palet.

The non-glandular hairs are not outgrowths of epidermal cells, but are inserted, as in the case of those of the intraspinal region of the burs, between the cells of the epidermis.

The sclerenchyma fibers (Fig. 5sch) occupy most of the area beneath the epidermis. They are thick walled, porous, strongly lignified and taper-ended elements with narrow lumina, polygonal to rounded-polygonal in transverse section. No distinct intercellular cavities such as Gayle [13] pictures and describes have been found between them. It is possible that the cavities noted by Gayle were breaks in the sections he studied due to the falling out of areas of

fibrovascular or sclerenchyma cells during the technique of sectioning.

Fibrovascular tissue (Fig. 5v) is found coursing through the sclerenchyma zone of the spine.

A series of sections (Fig. 4 A, B, C, D, E) made through varying levels of the spine show eight bundles (v) at the base. These are found to diminish in number toward the tip, due to the union of bundle strands, until only one fibrovascular strand is evident in the extreme distal region. Each fibrovascular bundle contains annular, spiral and scalariform tracheids and sieve tubes.

When burs are placed in weak alkaline solution for several hours and their spines subsequently examined microscopically, the epidermis appears broken and the sharp-pointed sclerenchyma fibers more or less detached. The latter are readily separated upon pressure. From the foregoing observations it appears logical to assume that the pain and inflammation which results after humans and lower animals are wounded by the spines of this bur are, in the case of mature spines, caused alike by the stimulation of nerve endings by the entire barbed spine and by its sharp sclerenchyma fibers, which may be loosened and detached in the flesh fluids. The sharp recurved barbs lacerate the flesh when the spine is removed, and, lowering the resistance of the tissues, subject the wound to invasion by pyogenic and other bacteria. This undoubtedly accounts for the delayed inflammation that results after removing the spine from the wound. In the case of injury from younger spines, the fluid containing what appears to be formates, which occurs in the lumen of barbs, may be injected into the wound, upon fracture of the sharp, brittle tips of these structures, and so intensify the pain.

Histology of the Scales and Palet.

The hyaline scale shows three strong nerves and is barbed with short, sharp-pointed, unicellular hairs at the summit and over the outer epidermis. Some of these hairs are hooked at their ends. Its epidermis consists of long cells, short cells, stomata and twin cells. The long cells are elongated longitudinally and have thin, indistinctly porous, wavy walls. Some of the short cells give rise to short unicellular, needle-pointed barbs. Others contain silica.

The membranous scales are thicker in texture than the hyaline scale, are three-nerved, and barbed at the summit and over the outer surface with hairs similar to those found on the hyaline scale.

The side walls of their long cells are thicker, and more closely wavy than those of the hyaline scale and the lumina are narrower.

The palet is ovate-lanceolate in shape and shows a keel with two prominent nerves. Its epidermal cells (Fig. 7) and hairs are somewhat similar to those of the membranous scales and are mainly distributed on the outer epidermis near the summit, and along the upper portion of the keel. The hairs are similar to those found on the other scales and measure up to 42 μ in length.

Histology of Fruit.

The fruit of *Cenchrus tribuloides* (Fig. 8) consists of pericarp, spermoderm, endosperm and embryo regions. As in the case of fruits of other grasses and cereals, the pericarp and seed coat are firmly united.

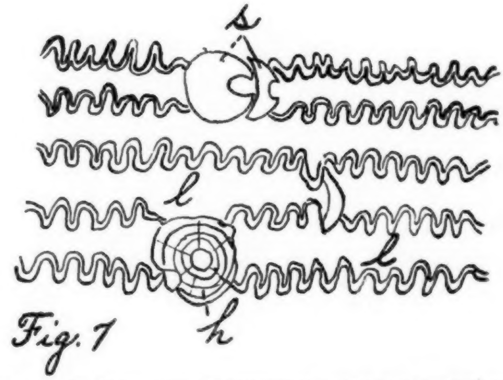

Fig. 7. Surface view of epidermis of palet showing long cells (l); twin cells (s) and base of hair (h), (highly magnified).

The pericarp comprises the following regions: (1) A layer of outer, colorless cells with beaded side and end walls that are generally elongated longitudinally and arranged end to end in rows, the double side walls being about 4.2 μ thick. No hairs have been found on this layer; (2) a layer of short, irregular-shaped, beaded-walled cells, and (3) a layer of loosely arranged tube cells of vermiform shape.

The spermoderm consists of a layer of elongated pale brown cells.

The endosperm shows an outer layer of aleurone cells (Fig. 9al) similar to those of cereals, and a broad area of starch parenchyma,

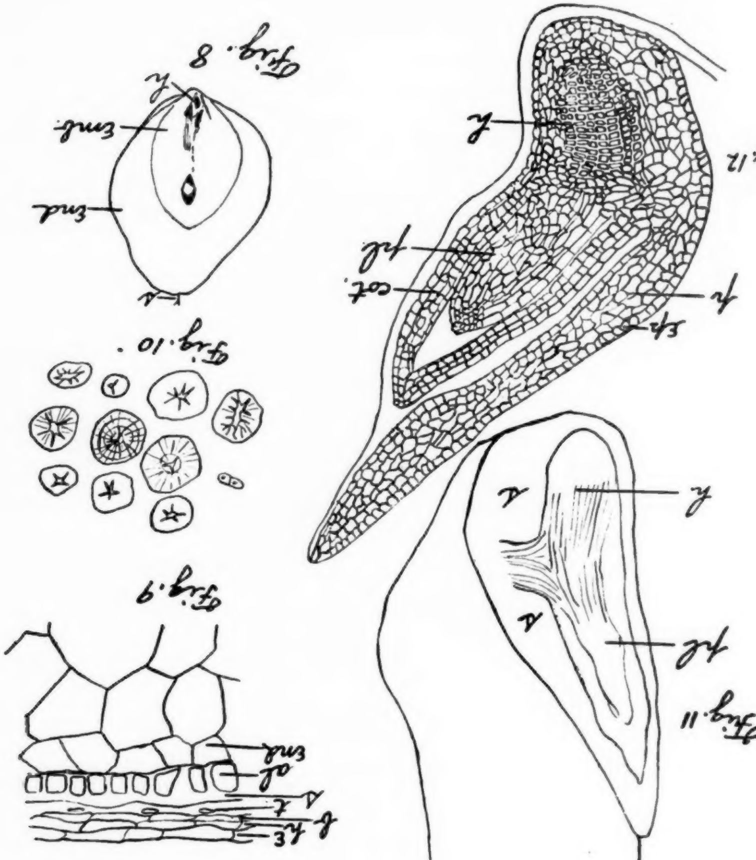

Fig. 8. Fruit of *Cenchrus tribuloides* L. showing scar at base (h); endosperm area (end); embryonic area (emb) and style (s).
Fig. 9. Transverse view of outer portion of *C. tribuloides* fruit from section cleared with chloral, showing epicarp (e); hypodermis (h); irregular shaped, beaded-walled cells (b); tube cells (t); spermoderm (s); aleurone cells (al); starchy endosperm (end), (highly magnified).
Fig. 10. Starch grains from cells of starchy endosperm of *C. tribuloides*.
Fig. 11. Diagrammatic sketch of median longitudinal section of *Cenchrus tribuloides* caryopsis, showing regions of fruit wall and seed coat (p); endosperm (end); scutellum (s); plumule (pl); cotyledonary sheath (cot); and hypocotyl (h).
Fig. 12. Median longitudinal section through embryo of *Cenchrus tribuloides*, showing details of its various parts. Epidermis (ep), and parenchyma (p) of scutellum; cotyledonary sheath (cot); plumule (pl), and hypocotyl (h).

the cells of which are polygonal in outline and filled with starch grains. The latter (Fig. 10) are for the most part simple, but occasionally two-compound. The larger grains vary in outline from spheroidal to polygonal to rounded-polygonal and show a several cleft hilum and often concentric striations. They are mostly 22 to 25 μ in diameter.

The embryo (Fig. 12) consists of a good-sized scutellum, a cotyledonary sheath, a plumule and a hypocotyl. The epidermal cells of the scutellum are hyaline and the parenchyma cells beneath are loaded with starch granules, which are much smaller than those found in the endosperm.

Histology of the Stem.

The outer surface of the stem of this plant shows a pronounced longitudinal grove and a number of longitudinal striations. Transverse sections exhibit, therefore, a sub-circular outline with a broad, shallow indentation and a number of smaller sinuses along the margin.

The epidermis (Fig. 13*e*) is composed of thick-walled yellow cells with prominent outer cuticle. The outer walls of these cells are convex in cross section. In surface sections, the Epidermis (Fig. 14) shows the characteristic long (*l*) and short cells (*s*) of the grasses. The long cells have porous side and end walls. Stomata (*st*) are present.

Directly beneath the epidermis along the broad grove is a zone of four to five layers of yellowish sclerenchyma fibers with strongly lignified walls, forming the sclerenchyma sheath (Fig. 13*sch*). Elsewhere several layers of cortical parenchyma cells (*c*) are evident underlying the epidermis with the exception of the ridges between the striations which are strengthened by about four to six layers of sclerenchyma fibers (*f*). There is no distinct endodermis. The sclerenchyma sheath surrounds some of the closed collateral bundles. In some instances bundles are attached to it along its inner edge.

Just within the sclerenchyma sheath is a broad pith (*m*) filling up the center of the younger stem. Coursing through this are to be noted a number of additional closed collateral bundles (*b*) that are not attached to the sclerenchyma sheath. Each of these is surrounded by a band of sclerenchyma fibers (*scl f*). Annular, spiral and pitted tracheæ are present in the xylem of the bundles.

The pith is composed of polygonal cells and moderate sized, angular, intercellular-air-spaces. The cells are broadest in the center and break down in this region of the internodes of the older stems.

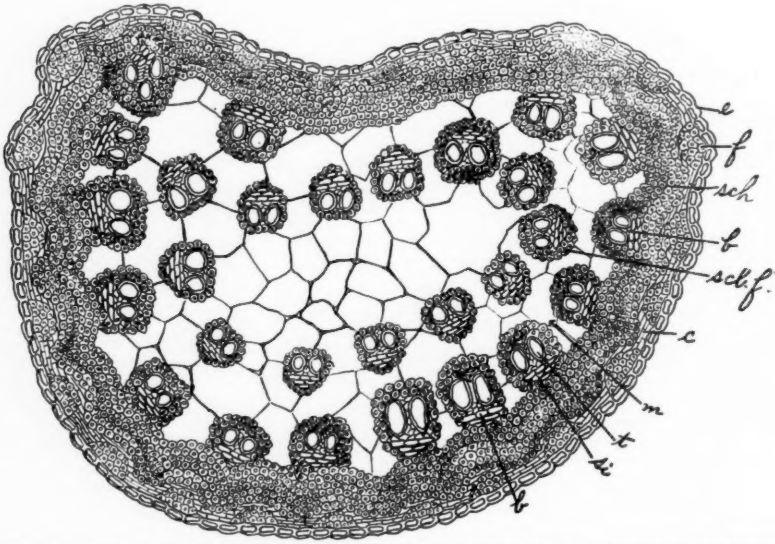

Fig. 13. Transverse section of stem of *Cenchrus tribuloides* L. showing epidermis (e); group of hypodermal fibers (f); sclerenchyma sheath (sch); closed collateral bundle (b) attached to sclerenchyma ring; tracheæ (tr) and sieve tubes (si) of bundle; sclerenchyma fibers surrounding bundle (scl. f.); cortical parenchyma (c); pith (m), (greatly magnified).

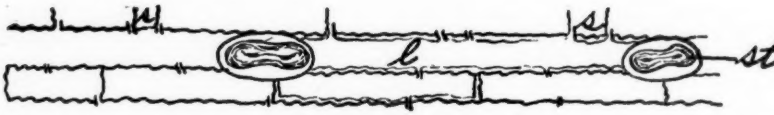

Fig. 14. Surface view of portion of epidermis of stem of *Cenchrus tribuloides* L. showing stomata (st) long cell (l) and short cell (s), (greatly magnified).

The Chemical Composition of Cenchrus Tribuloides.

The chemical composition of the various members of the *Gramineæ* which have been subjected to more or less thorough analysis, have, as a rule, shown nothing in the way of toxic and irritating principles. The material used in the following analysis consisted of the mature fruits of the plants furnished by Dr. H. Marshall Taylor, of Jacksonville, Florida, pulverized in an iron mill to a fineness of a No. 60 powder.

The ash determinations and analyses were made upon unground material so as to eliminate any possible source of contamination from the milling. The ash on a number of closely agreeing determinations averaged 3.95 per cent. Of this about 10 per cent. was silica, while qualitative tests showed the balance to be made up of compounds of potassium, calcium, manganese and iron.

The moisture in the air dried, powdered material was found to be 8.17 per cent.

The water soluble extractive was found to be 3.55 per cent., of which 0.55 per cent. was reducing sugars, the balance being mucilaginous in character. Tests were made upon the watery extractive matter for alkaloids and glucosides, with negative results. Starch and tannin were also absent. Mucilage was present. Positive tests for an aldehyde were obtained in the aqueous extractive, but the specific identity of the substance could not be determined owing to the smallness of the amount. The reaction of this aqueous portion was very faintly acid, but here again the amount was so small that identification of the acid became impossible.

The alcoholic extractive amounted to 3.17 per cent., mainly chlorophyll and resinous and oily constituents. No alkaloids or glucosides.

The petroleum-ether extractive amounted to 2 per cent., principally fat.

The extraction with ethyl ether showed 3.3 per cent. The acid number of the ether extract was 19.10, the saponification number 197, and the iodine number 60. It is certain that there is not present any alkaloids, glucoside or similar toxic principle.

Physiological tests were made of the various extractives to determine the possible presence of specifically irritating substances, either by taste or inoculation into a pin prick, but the material appears to be devoid of activity or irritating properties.

A careful search of the literature shows no evidence of chemical work having been done upon this plant at any time in its history.

The foregoing data was indicative of the fact that in the mature state at least, the fruits of this plant are entirely free from constituents of an actively toxic or irritating character.

LIST OF ILLUSTRATIONS.

Fig. 1. *Cenchrus tribuloides* L. x ⅛.

Fig. 2. Burs of *Cenchrus tribuloides* L. (natural size).

Fig. 3. *A*. Spine *of Cenchrus tribuloides* L. showing barbs (b) below and unicellular hairs (h) above. *B*. Portion of epidermis of spine showing insertion of hair (h) between epidermal cells (e). *C*. Barb enlarged.

Fig. 4 (A. B. C. D. E.). Diagrams of cross-sections through several regions of the spines of *Cenchrus tribuloides* L. showing the character of the vascular areas (v) from base to near the tip of the spine.

Fig. 5. Transverse section through the spine of *C. tribuloides* L. near its termination showing barbs (b), sclerenchyma fibers (sch.) and vascular tissue (v).

Fig. 6. Fruit of *Cenchrus tribuloides* L. invested by palet.

Fig. 7. Surface view of epidermis of palet showing long cells (l); twin cells (s) and base of hair (h).

Fig. 8. Fruit of *Cenchrus tribuloides* L. showing scar at base (h); endosperm area (end); embryonic area (emb) and style (s).

Fig. 9. Transverse view of outer portion of *C. tribuloides* fruit showing epicarp (e); hypodermis (h); irregular shaped, beaded-walled cells (b); tube cells (t); spermoderm (s); aleurone cells (al); starchy endosperm (end).

Fig. 10. Starch grains from cells of starchy endosperm of *C. tribuloides.*

Fig. 11. Diagrammatic sketch of median longitudinal section of *Cenchrus tribuloides* caryopsis showing regions of fruit wall and seed coat (p); endosperm (end); scutellum (s); plumule (pl); cotyledonary sheath (cot); and hypocotyl (h).

Fig. 12. Median longitudinal section through embryo of *Cenchrus tribuloides* showing details of its various parts. Epidermis (ep) and parenchyma (p) of scutellum; cotyledonary sheath (cot); plumule (pl); hypocotyl (h).

Fig. 13. Transverse section of stem of *C. tribuloides* showing epidermis (e); group of hypodermal fibers (f); sclerenchyma sheath (sch); closed collateral bundle (b) attached to sclerenchyma ring; tracheæ (tr) and sieve tubes (si) of bundle; sclerenchyma fibers surrounding bundle (scl. f.); cortical parenchyma (c); pith (m).

Fig. 14. Surface view of portion of epidermis of stem of *C. tribuloides* showing stomata (st); long cell (l); short cell (s).

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NOTES ON THE MILK PROBLEM.

By Henry Leffmann, A. M., M. D.

The detection of adulterations in market milk constitutes one of the most important and difficult problems of food control. Milk is one of the few foods largely eaten raw, and, hence, sanitary control must include not only variations, natural or intentional, in the proportions of the ingredients, but the detection of pathogenetic organisms. At any point in the collection and distribution of milk contaminations may occur. The attention of sanitary chemists has been most largely concentrated on the determination of the limits of the principal constituents, especially proteins and fat, and a vast amount of data has been accumulated in the last fifty years, but much of the earlier work is vitiated by the use of erroneous methods. Wanklyn made systematic investigations of the composition of milk samples as offered in London, using a process of ether extraction which is now known to be defective, but he did good service in calling attention to the adulteration of milk supplied to public institutions, and his results, published in book form, became a starting point for other workers. He showed, among other things, that the lactometer, as then used, was not a trustworthy instrument, since it was possible to manipulate milk so as to preserve its gravity although fat was withdrawn and water added. The present condition of milk lactometry was fully discussed by Horn in a recent issue of this journal.

Nearly a half century ago, the British Society of Public Analysts took up the question of the limits permissible for market milk. The British Food and Drugs Act did not establish any standards, but simply provided that the article sold should be "of the nature, substance and quality demanded by the purchaser," hence it became necessary for the local analyst to state what was the composition of

the normal substance. The Society adopted certain limits which were believed to be liberal, that is, not setting too high a composition, yet as Dr. Paul Vieth said, in the discussion, "It must be remembered that the cows have not been asked, nor given their opinion on the question, and they may sometimes give milk below standard." Strict control over the composition and cleanliness of milk finally spread over the whole civilized world, yet some of the features of the problem are still not fully solved.

A satisfactory method of detecting added water has always been much desired. In early days it was thought that the detection of nitrates might give a clue, but this was found to be of no practical value. The employment of the immersion refractometer was a great step forward, since it was shown that milk serum prepared by the copper method from an unwatered sample, will not fall below the reading of 36, though it is recognized that a dilution of ten per cent. might be made to some samples without the reading falling below this figure. Passing over some other suggestions which have gone to the limbo of forgotten things, it will be of interest to present some data concerning the latest and most promising of the procedures for detecting watering. This is the determination of the freezing point.

An interesting summary of the application and results of cryoscopy applied to milk samples is presented in the recently published twenty-sixth annual report of the Connecticut Agricultural Experiment Station, being the report on food and drugs for the year 1921. The report was prepared by Dr. E. M. Bailey, chemist in charge of the Analytical Laboratory. The section on milk is only one of many comprising the whole range of laboratory work during the year, and does not enter into the theory and methods applying freezing point determinations. Information on those lines will be found in a paper by Hortvet in *Jour. Ind. Eng. Chem.* 1921, 13, 198. Hortvet has outlined a standard method. Dr. Bailey's data are compiled not only from his own work, but from that of numerous co-workers whose services are duly acknowledged. Four types of investigations were carried out. Milk from normal cows, normal herds, normal cows under somewhat abnormal conditions, diseased or physically abnormal cows.

The freezing point of milk is a physical constant ranging within narrow limits, that is, from —0.530° to —0.566° C. As the depression is due to salts in solution, addition of ordinary water will

diminish the influence of such salts, and the freezing point will be nearer the zero. Results are given of determinations on nearly three hundred samples, many in duplicate, with partial or complete chemical analysis. The inferences drawn from the investigation are as follows:

There is an appreciable difference in freezing point depression between morning and evening milk, the variation being greater than that observed between morning or evening samples respectively from day to day.

Minimum depressions ranging from —0.530° and the maximum of —0.566° from normal individual cows, and for normal herds a minimum of —0.5930° and maximum of —0.562° are reasonably substantiated.

Moderate exercise or moderately delayed milking does not appreciably affect the freezing point. Long-delayed milkings or severe exercise, strain or fatigue may give materially increased depressions.

The milk from tubercular cows or those in poor or abnormal conditions has generally fallen within the limits of normal milk, but some instances of decreased depression have been noted.

Some points, especially the effect of disease and abnormal conditions still remain for further study. It appears that in the freezing point method the chemist has a satisfactory procedure for the detection of watering.

The milk problem is by no means limited to the mere detection of skimming and watering. *Clean milk,* that is, milk free not only from pathogenetic organisms, but from the common putrefactive forms is necessary to the well-being of the community. Collection of the milk from healthy cows by clean, healthy milkers, transportation to market under proper conditions, distribution to consumers so as to prevent any contamination are essential. Much has been done of late years to bring about these controls. The large companies engaged in the handling are well equipped and efficient and it seems that the milk problem will never be fully solved until individual dairymen and purveyors are eliminated and the entire service is in the hands of those who can command scientific supervision at every point.

HAY FEVER DIAGNOSIS AND TREATMENT.*

By Ivor Griffith, Ph. M.

Newer developments in the field of hay fever diagnosis and therapeusis have completely eclipsed the theories and practices indulged in when this field was first cultivated. This, of course, is the general turn of affairs when any new medical idea is promulgated, for it is only by experience and experiment that the true value of medical discoveries may be obtained.

Formerly it was held that hay fever or pollinosis was due to the unusual sensitiveness, or idiosyncrasy of the sufferer to the pollen of a vast variety of plants out of Nature's garden. But Nature's garden is expansive, and the old conception of diagnosis meant that a large analytical botanical chart was followed in order to establish the sensitiveness of the person under examination. As time went on, however, it was found that a real majority of patients responded uniformly only to a small class of pollen proteins. Then again when closer study was made of pollination methods, it developed that comparatively few plants use the simplest way of broadcasting their pollen grains, namely by trusting it to the wind. And it is wind-borne pollen that is responsible for most hay fever infections.

So we find, as time went on, that the diagnosis and treatment of hay fever causes became more simplified, and particularly so by the brilliant conception of a "grouping" of the pollen extracts. Investigation proved conclusively that patients who are sensitive to pollens may be "botanically" classified according to plant families. This botanical relationship of the pollens has even been carried so far as to conceive that patients who are sensitive to more than one pollen of the same family may be treated (or desensitized) by using a pollen extract belonging to only one member of that family, the one chosen being generally the one affording the most pronounced reaction in the diagnostic test.

Scheppergrell, the pioneer in this field of investigation, reduces the principal hay fever pollens into four groups as follows:

Group 1. Gramineæ (the grasses).

Group 2. Ambrosiaceæ (the ragweeds).

†Read before the monthly meeting of the Staff of the Stetson Hospital.

Group 3. Chenopodiaceæ (the chenopods).
Group 4. Artemesias (the wormwoods).

This is a natural botanical grouping. Scheppergrell further summarizes the gross characteristics of hay fever plants as follows:

(1) They are wind pollinated.

(2) They are prolific.

(3) The individual plants are inconspicuous as to color and odor, and pollen formation is very active.

Now then the simplified character of present methods of hay fever diagnosis and treatment may be exemplified thus. If a given person is sensitive to corn pollen or red top or orchard grass, he may be desensitized with the most prolific member of the group (the gramineæ) namely, timothy. This class or group is generally termed the spring group, and is responsible for the early hay fever. Thus again ragweed will desensitize not only against ragweeds but also against closely related plants of the same group such as cockleburs, golden rod and red root. Sometimes, however, in the case of multiple sensitiveness it is necessary to use in addition to the class or group representative, the other members of this group to which the patient displays sensitiveness. This is not resorted to until it is established that the patient is not deriving any benefit from treatment with the group representative.

The botanical grouping referred to has displaced the older seasonal grouping, and it is no longer considered good practice to label the treatment products as Fall, Mixed Fall, Spring or Summer extracts.

Group 1 and Group 2 are the most common offenders. Group 3 includes a heterogeneous collection of plants of wide distribution, which are important contributing agents in the perennial hay fever cases. The long blooming dock, *Rumex crispus* is probably the major offender in this group. Group 4 includes the several species of the prolific wormwoods which are the chief causes of hay fever in the Pacific and Rocky Mountain States.

In preparing these agents for the market, the pharmaceutical houses have used several methods, each manufacturer selecting a special procedure and insisting that the chosen procedure is best. There is, therefore, a wide disparity in the potency and dependability of pollen proteins. It is our experience, however, in using

these pollen extracts in the laboratory, that the acetone insoluble pollen of the alkalinized aqueous extract of the sifted, dried pollen, yield best results for both diagnosis and treatment. The protein nitrogen content is high and they are more uniform and stable. Knowledge of the protein nitrogen content,* is valuable since it is necessary to use this datum in order to establish the pollen unit.

A word or two in regard to the conduct of the test and the mode of treatment.

Diagnostic Tests.

The technic of the cutaneous test, which is by far the preferable, is as follows: Cleanse patient's forearm with alcohol and rinse well with sterile water. With a sharp needle make a small linear scratch about one-eighth inch long on the skin of the forearm and avoid drawing blood. Place a small drop of a N/100 NaOH solution on the scarified area. Over this dust some of the pollen extract and rub gently but thoroughly into the scarified area. This is repeated at two inch linear intervals with the other extracts. It is always necessary to run a control scarification, using only the N/100 NaOH. The results are recorded twenty to thirty minutes after applying the tests.

Positive reactions vary in their intensity and no reaction is considered positive that is not definitely larger than the control reaction. A marked positive reaction consists of a definite urticarial wheal with a surrounding area of erythema. A moderately positive reaction shows a similar picture, except that the characteristics are not so pronounced. A mild reaction shows very little of the wheal but a distinct area of erythema. The protein or proteins giving reactions are usually the cause of the symptoms. After ascertaining the cause in this manner, the treatment is next considered.

Prophylactic Treatment.

Prophylactic treatment should begin four to six weeks before the attack is scheduled, and from twelve to twenty injections given. As soon as the specific pollen occurs in the atmosphere, however, the dose must be reduced, as the patient is additionally exposed to atmospheric pollen.

*Noon establishes the following factor for all pollen proteins: .001 = 1 pollen unit.

The injecting solution is prepared from the pollen extract, so that a cc. represents about 100 units (calculated on the basis of N times 6.25 content). These solutions may be procured from the manufacturers and so may all of these products, both diagnostic as well as the therapeutic agents.

The accepted scheme of dosage is as follows:

Dose	*No. of pollen units*
1	12.5
2	25
3	50
4	75
5	100
6	125
7	150
8	175
9	200
10	225
11 to 20	250

In conclusion our experience has been that a large percentage of cases of hay fever infection can be modified if not cured by the pollen extract treatment.

ABSTRACTED AND REPRINTED ARTICLES

PHARMACOGNOSY AND THE PHARMACEUTICAL CURRICULUM.*†

By H. G. Greenish, D. Sc. (Paris), F. I. C., F. L. S., Ph. C.

As text of the address which custom requires that the President of the British Pharmaceutical Conference should deliver at the annual meeting, I propose to take the subject of "Pharmacognosy and the Pharmaceutical Curriculum." I have selected this subject partly because it is one of which I may claim to have some knowledge, but chiefly because I look upon pharmacognosy as a field of knowledge which the pharmacist is peculiarly fitted to cultivate, and in which he should have a claim to be considered an expert. The

*From the *Chemist and Druggist*.

†Presidential address before the British Conference.

Pharmaceutical Society, with its museums, herbaria, laboratories, library and school, and with its fine record of eighty years, is entitled to and should regard itself as the headquarters of pharmacognosy in this country, as the body to which reference should be made for any information respecting crude drugs. This position can be retained only by maintaining those sections of its activity that relate to pharmacognosy in a state of the highest possible efficiency. I propose, therefore, to indicate the scope of the subject, to outline the training which, in my opinion, the pharmacist should undergo to enable him to possess expert knowledge of it, and to point out a few of the many details upon which research is necessary. For without research no real progress is possible, and this fact must be borne in mind when arranging a curriculum for the student, and also when allotting lectures and practical work to the teachers. Both the University of London and Board of Education recognize the necessity for research work by the teachers, and insist that they shall be allowed sufficient freedom from lectures and administrative work to allow them to prosecute research in their various departments.

Pharmacognosy Defined.

It will be desirable first of all to be quite clear as to what we mean by pharmacognosy. I have heard it defined, or, perhaps, rather described, as the "spotting of drugs." I have heard it said that all the pharmacist needs to know is what the drug is, what it costs, and how long it will keep. If the authors of these descriptions were in earnest, they must have had a very limited experience of pharmacognosy, and a very poor opinion of the knowledge that a pharmacist ought to possess.

According to Professor Tschirch, the term "pharmacognosy" was first used by Seydler as the title of a small work which he called "Analecta Pharmacognostica," published in 1815. It was adopted in 1825 by Martius, who explained it to mean the discipline that investigated remedial agents from all three kingdoms of Nature as regards their origin and quality, tested them for purity and examined them for substitution and adulteration. Subsequently the drugs derived from the mineral kingdom were separated from pharmacognosy and formed the basis of pharmaceutical chemistry. Professor Tschirch, who, it will be remembered, as Hanbury Medallist delivered the inaugural address at the opening of the School of Pharmacy in 1909,

defines pharmacognosy as that science which deals with the investigation of drugs of animal or vegetable origin from all points of view (excepting only that of their therapeutical action), which aims at acquiring an accurate scientific knowledge of them, at describing them correctly, and at welding our knowledge of them into a scientific entity based on the chemical relationship of their active constituents.

Such a knowledge of pharmacognosy presupposes a knowledge of botany, chemistry, physics, and elementary zoology; it embraces geography, history, ethnology, and etymology, at least as applied to drugs; it includes the collection, preparation, and commerce of drugs. This represents what one of the most advanced thinkers in pharmacognosy understands to be the object of the science, and while doubtless many may differ in some respect or other, there can be little doubt that in the main it is correct.

Such are the subdivisions of scientific pharmacognosy as defined by Professor Tschirch, and they must be mastered by those who aspire to teach pharmacognosy; but it does not by any means follow that they should be mastered by the student of pharmacognosy or by the practical pharmacist. It is for the pharmacist to utilize the results arrived at by the scientific pharmacognosist and turn them to practical account. Thus it is for the scientific pharmacognosist to investigate the structure of vegetable and animal drugs in the minutest detail, and to point out distinguishing features, but it is for the practical pharmacognosist that is the pharmacist, to utilize these results in order to enable him to recognize the drugs, to distinguish them from possible substitutions, to detect adulteration, to judge of their quality by their physical characters, to identify them when powdered, and to determine the purity of the powder. The pharmacist should further be in a position to apply the results of the chemical investigation of drugs to the determination of their quality by chemical assay, and he should, in addition, have a knowledge of indigenous medicinal plants, and also of indigenous toxic plants, even if these are seldom employed medicinally.

Applied Pharmacognosy.

There are doubtless many pharmacists, especially among those who view the subject from a purely utilitarian point, who consider that this knowledge may be sufficiently acquired by the pupil during his pupilage in a pharmacy. In refutation of this, let me quote to

you the pertinent remarks of Dr. A. T. Thompson, in his first lecture on materia medica to the students of the School of Pharmacy in 1842. He said: "It may be argued that the daily occupations in the laboratory, in the storehouse, and in the shop of the chemist and druggist are sufficient, and perhaps the best mode of teaching the pupil the knowledge of the physical characters of drugs, and the leading features by which the good are distinguished from the bad; the position is certainly not devoid of force. Experience and observation are the means of acquiring such information; but we may have eyes and yet not be capable of employing the vision they bestow to advantage. How many thousands pass from the cradle to the grave without having made an accurate observation with respect to objects daily presented to their view! And if it is a just remark that the painter enjoys a double sense of vision, I must contend that it is requisite to educate the powers of observing in order to observe well; and need I argue that he who understands the branches of science to which I have referred (zoology, botany and mineralogy) is more likely to attain a correct acquaintance with physical characters than he who has merely had his eye directed to them without any systematic method of examination and of comprehending the causes of the variety they display." As the purely utilitarian point of view is not infrequently advanced as a reason for learning as little as possible about anything unless what is learnt is directly translatable into pounds, shillings and pence, allow me to explain why, in my opinion, the pharmaceutical student should learn as much as possible about pharmacognosy and the sciences allied to it, particularly botany and pharmaceutical chemistry. As a member of the community, it is the chief duty of the pharmacist to provide the public with medicines, simple or compound, of the proper quality. These medicines consist of, or are prepared from, either vegetable or animal drugs on the one hand, or from more or less pure chemical substances on the other, and it is the business and duty of the pharmacist to have as thorough an acquaintance as possible with them in order that he may be equal to the responsibilities he has undertaken. The utilitarian is, of course, perfectly entitled to his point of view. No valid objection can be raised to the sale of perfumes and hair-brushes by the pharmacist, but it is for those among us—and I hope they are many—who have higher ideals of pharmacy to see that the desires of the utilitarians are not carried into effect to the prejudice of the true interests of pharmacy.

Preliminary Requirements.

In order that the student may be capable of understanding and appreciating a course of instruction in scientific pharmacognosy, there can be no question that he should have had a thorough grounding in botany, chemistry and physics, and that he should possess an elementary knowledge of zoology. But, in addition to these sciences, he must also have had a preliminary general education of a distinctly higher standard than that which at present obtains with the majority of the entrants into pharmacy. He must have a good knowledge of geography (including physical geography) and of the history of the world, and a training in commerce and economics would be of distinct advantage to him. It is impossible for him to be in this position unless his preliminary education has been of a standard commensurate with the demands that will be made upon him, and one of the most hopeful signs for the progress of pharmacy in the future lies in the now generally accepted opinion that a considerable elevation of the standard of preliminary education is essential. The decision of the Pharmaceutical Society in 1897 to retain the Junior Examination of the College of Preceptors as one of the entrance examinations to pharmacy was fatal to real progress. This decision was apparently the result of a dread felt by many members of the Society that a raising of the standard of the entrance examination might be accompanied by a restriction of the number of entrants, and that consequently the aid necessary to pharmacists for the conduct of their businesses would be more difficult to obtain and command a higher remuneration. If this was really the case, then the future true welfare of pharmacy was sacrificed for the sake of present advantage. What has been the result? For the past quarter of a century the entrance examination into pharmacy has remained the same, while the standard of general education throughout the country has been steadily rising and the facilities for obtaining that education steadily increasing. In the years 1903-1913 about 70 per cent. of the students entering the Society's School of Pharmacy had attained the standard of education demanded by the easiest entrance examination only. I do not think I am exaggerating when I say that a large proportion of the entrants into pharmacy during the past twenty years have not been able to work out simple arithmetical sums and have been sadly lacking in general knowledge and in the powers of observation and deduction. Teachers have been attempting to erect a solid edifice

upon the most insufficient foundations, and in many cases the task has been too great.

In the Report of the Royal Commission on University Education of London, the Commissioners said that:

"A university works by the co-operation of its teachers and students in study and investigation, a process in which the student is trained to learn in an inquiring spirit, and the teacher is assisted in his endeavors to advance knowledge by the effort to communicate it to others, and by the stimulus which the youthful doubts and enthusiastic labors of his best students afford him. This co-operation, however, cannot be effectively realized unless certain conditions have been fulfilled. In the first place a sound general education is an indispensable basis of the undergraduate students' work. It is no doubt possible for a considerable amount of knowledge of a specialized kind to be acquired upon a relatively meagre groundwork of general education; but for the ordinary student a point is reached sooner or later, and more often soon than late, where all further advance is hampered, if not entirely prohibited, unless he has acquired the power of accurate expression and orderly thought. These are the two intellectual qualifications, which, stated in its most general terms, it is the aim of a sound general education to give, and if they do not exist, a large part of the benefits of a university training will be lost."

The Order of Study.

Assuming for the moment that a rise in the standard of preliminary education of the pharmacist is an accomplished fact, and that the student has passed his entrance examination, let us consider what should be his next step to fit himself for the study of pharmacognosy. Naturally a training in botany is the most important, as nearly all the drugs dealt with by the pharmacognosist are of vegetable origin. Should this knowledge be acquired before his pupilage in the pharmacy or afterwards? On this point opinion varies, not only in this country, but on the Continent also. In Belgium the scientific training precedes the practice in the pharmacy; in France the practice in the pharmacy precedes the scientific training. In either case the scientific training is continuous, and the whole time, energy and thought of the student is devoted to it. In this country the entrant into pharmacy is debarred from adopting the Belgian plan in its entirety, since he must have spent at least two years in a pharmacy or approved institution before he can present himself for the second or final part of the qualifying examination. He may adopt, and in

the past almost invariably has adopted, the French plan and passed through his pupilage before commencing his scientific studies. Sir David Prain, in his admirable address to the students of the School of Pharmacy last year, vigorously supported this arrangement and based his arguments largely upon the result of his experience as Director of Key Gardens. The late Professor Bourquelot also, one of the most advanced of pharmacists, was a strenuous advocate of the system, stating that his observation of the students who had passed through his hands was that the course of training in the pharmacy was invaluable for fostering and developing a scientific spirit in the pupils, and for giving them a thorough training in habits of neatness and cleanliness, and in the skillful manipulation of apparatus, which are of the greatest service to them in their scientific studies.

But the student of pharmacy in Great Britain may, under present regulations, adopt an intermediate plan. He may pass the first part of the qualifying examination before his pupilage and the second part after. In this case the continuity of his studies would be interrupted for two solid years. I have no doubt whatever that such an interruption would be a very severe handicap to him. Every teacher of botany, chemistry, or pharmacognosy who has had students return to him after an interval of two years spent in the practice of pharmacy knows the amount that can be forgotten in that time. We have had, unfortunately, sufficient experience of this in the case of those who, compelled by the war to abandon their studies, have returned to them after three or four years to find that they had not only forgotten much, but had to a great extent lost the habit of study. These men and women, who have thus suffered through no fault of their own, have our intense sympathy. But the pupil who has the option of making his study continuous or discontinuous and chooses the latter has only himself to blame if, later on, he finds himself handicapped. That he will be handicapped is, to my mind, certain. If he were dealing with botany alone, he might during his pupilage in the pharmacy maintain a certain continuity by means of evening or other classes, but when one considers that he would have to devote at least an equal period to physics and a much longer period to chemistry, then such a task, in conjunction with the daily work in the pharmacy, is more than any but the most robust can endure. If the pharmaceutical pupil decides to take his pupilage in the phar-

macy before his systematic course of study, then attendance at evening classes at one of the various technical schools may be useful, but such attendance must be strictly commensurate with his physical and intellectual vigor, and allowance must be made for the necessary time for homework in the same subjects. Such classes in botany, for example, may form a useful preliminary to, but cannot in any way replace, a systematic day course in a properly equipped institution as a groundwork upon which the study of pharmacognosy is to be based.

The Influence of Botany.

Let me now turn for a moment to consider the influence that may be exercised by the nature of the course of botany through which he passes. Without going into too much detail, I think it will be generally admitted that a course of general botany in which the illustrations required are drawn from drugs or from medicinal plants, and in which special attention is devoted to those sections that will be most needed by the pharmacognosist, such as anatomy, morphology, physiology and systematic botany, will best fit the student for the application of his knowledge on the study of pharmacognosy and eventually to the solution of its problems. At the same time it should be so broad that if at a later period the pharmacognosist desires to apply the principles of genetics to the cultivation of medicinal plants, he should at least have a foundation on which to build. In courses of general botany so little detailed attention is usually paid to the anatomy of plants that pharmaceutical students have to give to that part of their work time that should be devoted to the application of such knowledge to the examination of drugs. In the School of Pharmacy, and probably in other institutions in which the training is specially arranged for pharmaceutical students, this disadvantage does not obtain, as the botanical course is properly co-ordinated with the course in pharmacognosy to the distinct advantage of the student. Should the Society decide to accept for Part I. the certificates of other examining bodies, as, for instance, the Intermediate Examination for the degree of Bachelor of Science, then either such students must be placed under a disadvantage, or the courses in pharmacognosy must be adapted to suit them. In botany, at least, there is no doubt that the course best suited to the pharmaceutical student is one specially adapted to the particular objects that he has in view.

Some years ago the Minister of Education in Austria, referring to the introduction of a new curriculum and examination for pharmacists, said that care was to be taken that, as far as possible, the lectures and practical work in the various sciences should be specially designed for students of pharmacy. With that I cordially agree.

Pharmacognosy as an Examination Subject.

Let me now turn to pharmacognosy as a subject in the final part of the Qualifying examination, and inquire to what extent the student may reasonably be required to carry his acquaintance with it. Obviously, he should be required to be familiar with all the crude drugs described in the British Pharmacopœia. To these might be added other unofficial drugs such as those that form the basis of galenical preparations occasionally if not frequently prescribed or demanded by the public. To ensure that the candidate has had sufficient training in practical work and has not contented himself with a superficial recognition of the drug without knowing, searching for, and finding the diagnostic characters, he should be required to demonstrate these diagnostic characters to the examiner, using for this purpose either qualitative chemical tests or examination by means of the lens, or, if necessary, by means of the microscope. As the candidate will have already received the requisite preliminary training in botany, examination by means of the microscope, even if the cutting of a section is necessary, should present no difficulty. He should further be required to have a general knowledge of the chief constituents of the most important drugs, of their localization, of the secretory tissue in which opium, turpentine, myrrh, etc., are contained. To put it briefly, the time has arrived when the training and examination in pharmacognosy should be directed towards imparting to and requiring from the candidate a more thorough, a more scientific, and a more practical knowledge of crude drugs. Such requirements will have the advantage of checking a far too prevalent disposition to make the subject almost entirely a pure effort of memory.

With the conditions under which the pharmacognosy will, in the very near future, be taught, bearing in mind the large number of institutions that have been approved for the purpose, a syllabus of the examination will, I suppose, remain a necessity, although the length of the course and the number of hours to be devoted to the subject should be a sufficient guide to both teacher and examiner.

The Royal Commission in their Report condemned the syllabus by saying:

"The syllabus is a device to maintain a standard among institutions which are not all of university rank. The effect upon the students and the teachers is disastrous. The students have the ordeal of the examination hanging over them and must prepare themselves for it or fail to get the degree. Thus the degree comes first and the education a bad second. They cannot help thinking of what will pay; they lose theoretic interest in the subjects of study, and with it the freedom, the thought, the reflection, and the spirit of inquiry which are the atmosphere of university work. They cannot pursue knowledge both for its own sake and also for the sake of passing the test of an examination. And the teachers' powers are restricted by the syllabus; their freedom in dealing with their subject in their own way is limited; they must either direct their teaching to preparation for an examination which is for each of them practically external, or else lose the interest and attention of their students."

The problem is not an easy one to solve, but in the interest of the education of the student as contrasted with preparation for examination, the attempt to solve it should be made, and in the case of the subject with which I am dealing its solution should not be an impossible task. In any case the syllabus, if syllabus there must be, should be couched in terms as general as possible, and both teachers and examiners should be pharmacists, either men or women, who have received a thorough training in scientific pharmacognosy.

Advanced Training in Pharmacognosy.

The next question to be considered is the nature and scope of the advanced training in pharmacognosy to be undertaken by the student who has passed the qualifying examination. Undoubtedly a more thorough acquaintance with the minute structure of the more important drugs and an efficient training in the identification of powdered drugs the determination of their freedom from adulteration, and the analysis of mixed powders should occupy the first position. The student should also acquire such a knowledge of the chemical methods of assaying drugs as to allow of his undertaking such work with confidence in his results, and he

should extend his general knowledge of the active constituents of the more important drugs and their relation to one another. The examination in pharmacognosy for the Major qualification should be based on similar lines. In this respect I think it is generally admitted that the present examination is lamentably defective. It is imperative that the time allotted to it should be doubled, and that the scope of the examination should be revised.

The remark is frequently made that the Major qualification is of little or no direct advantage to the pharmacist in business. If an embryo pharmacist determines to become and remain a trader pure and simple, deriving an income from his trading without a thought of advancing himself in a knowledge of his craft beyond the minimum legal requirements, and without a desire to raise the standing of his craft beyond that of a trade, he is at liberty to do so. But it is inconceivable to me that any intelligent pharmacist should hold the advantage of a thorough education in his craft in so little esteem and have so poor an opinion of his own ability to profit by it, as to refrain from carrying his training to the highest possible limit of his financial position. The words of an editorial article, probably by Jacob Bell, in the "Pharmaceutical Journal" of 1847, apply with equal force today:

"The existence of such an institution (the School of Pharmacy) was an innovation, an inroad on the accustomed prejudices of a body of tradesmen who had been accustomed to estimate every advantage, whether moral, social, or political, by pounds, shillings and pence; and we were from the beginning quite prepared for the inquiry. How much shall we gain by it? It would be difficult to convince a child that by learning his A. B. C. he is acquiring the means of subsistence, but it ought not to be difficult to convince a chemist that by obtaining a knowledge of his profession he is deriving a similar advantage."

There is some indication it is true, of an increased desire on the part of those who have passed the Qualifying examination to proceed to the Major, but it is not possible to estimate the exact position. I am well aware that certain suggestions have recently been made with the object of adding to the value of the Major examination and so attracting more candidates. These suggestions do not, however, touch the subject of pharmacognosy, so that I must content myself with simply stating that in my estimation the pharmacist should master the work that is his own

before he attempts to acquire expert knowledge of other branches of science.

Post-graduate work in pharmacognosy and the problems in pharmacognosy that await solution must next claim our attention. Although the Pharmaceutical Society has provided research laboratories and offered inducements to advanced students to carry out investigations in them, the number that have availed themselves of the offer has not been large. The reason for this is probably to be found in the absence of any tangible reward for the time and labor expended. Consequently the pharmacist who has passed the Major examination and wishes to continue his studies usually aims for the degree of Bachelor of Science of the University of London or the Fellowship of the Institute of Chemistry, and with either or both of these he is usually content. Neither of them involves the necessity for research work; consequently it is seldom that he carries out any research, with the result that he loses an invaluable training, and pharmacognosy is deprived of a contribution to the solution of one at least of its problems. Indeed, it is not too much to say that the training in scientific pharmacognosy is incomplete until the student has carried out at least one research in some branch of the subject.

A Post-Graduate Student's Goal.

Recent regulations of the University of London have, however, considerably altered the position of students of pharmacy by bringing within their reach a tangible reward for their post-graduate studies. I allude to the degree of Doctor of Philosophy. The conditions for taking this degree are not very onerous. The candidate must have graduated in the faculty of theology, arts, science, or economics in the University, or in an approved foreign university, at least two years previously, and must submit to the University for approval the subject of a thesis which must form a distinct contribution to the knowledge of the subject chosen and afford evidence of originality; he must also submit to an oral or written examination on a subject relevant to the thesis. After taking the degree, the candidate may proceed to a higher degree in the same faculty. An internal student must carry out the research for his thesis under the supervision of a recognized teacher of the University, though not necessarily in the laboratory of one of the constituent colleges of the University. Under these conditions it is possible for both internal

and external students to carry out the work for their theses in the research laboratories of the Pharmaceutical Society, and at the present moment a graduate of a foreign university is so working in the pharmacy research laboratory, the subject of his thesis, which has been accepted by the University, embracing work in the field of pharmacognosy, both on the botanical and chemical sides. Such work is of inestimable value both to the post-graduate student and to the teacher. The very condition that the thesis "must afford evidence of originality" encourages them to develop their work along their own lines of thought, and liberates them completely from the strangling influence of a syllabus.

A number of the more advanced students of the School of Pharmacy, after passing their Major examination, proceed through the Intermediate Examination in Science to the degree of Bachelor of Science. There is now an additional inducement for them to continue their studies, and by means of research work carried out in the Society's research laboratories, proceed to the degree of Doctor of Philosophy. The progress of such students eventually to the degree of Doctor of Science would be much facilitated if arrangements could be made with the University to accept pharmacognosy as one of the subjects for the degree of Bachelor of Science on lines similar to those adopted some years ago in the Universities of Manchester and Glasgow.

The field of pharmocognosy is so wide and the problems that await solution are so diversified in their nature that no difficulty will be encountered in selecting subjects for theses that will appeal to the varied abilities and special qualifications of post-graduate students, who will doubtless be encouraged to put forth their utmost powers to give their work a claim to be classed with the researches of eminent pharmacists who have preceded them. I may mention the isolation of the active constituents of drugs on which so much admirable work has been done by the late Professor Bourquelot and by Dr. Power and Dr. Henry; on the drugs and other useful plants of the (French) colonies by Professor Perrot; on the chemical assay of drugs by Farr and Wright; on the botanical identification by that unrivalled master of the subject, E. M. Holmes; on the localization of the active constituents by Professor Goris. Much, indeed, has been accomplished by these eminent men, all of them pharmacists, but much more remains to be done.

An Experimental Station for Pharmacognosy.

For example, further researches on the influence of selection, breeding and manuring in increasing the amount of active constituents in plants are urgently required. In this respect it is unfortunate that no experimental station exists in this country in connection with the Pharmaceutical Society. I mean such a station as the Wisconsin Pharmaceutical Station. This station is a co-operative enterprise between the office of Drug Plant and Poisonous Plant Investigation of the Bureau of Plant Industry of the United States and the Pharmaceutical Experiment Station of the Department of Pharmacy of the University of Wisconsin. Its establishment was endorsed in 1917 by the National Association of Retail Druggists, which resolved:

"That this Association go on record in favor of the establishment of a pharmaceutical experiment station in every State of the Union and the support, in part at least, of such stations by the Federal Government for the benefit of pharmacy in general and the highly important vegetable materia medica in particular."

The station receives a contribution of $5,000 a year from the Federal Government. It is aided by contributions from various pharmaceutical firms interested in the work, and, in conformity with a resolution adopted by the Alumni of the University of Wiscoinsn, has established a research fund. When discussing the introduction of the bill to establish the station, the Alumni stated in their resolution that "appreciating that the professional standing of the pharmacist depends as largely upon the advancement of the science and art of pharmacy as upon the services which he renders more directly to society, the pharmaceutical Alumni of the University of Wisconsin have decided to raise a research fund to be administered by the Board of Regents."

Such a station, of however modest a nature, would be invaluable as an aid to the furtherance of scientific pharmacognosy in this country, and there would seem to be no insuperable difficulty to its establishment, if not as an independent station, possibly as an adjunct to one of the agricultural institutes. At present the research laboratories of the Pharmaceutical Society, which, as I have said, should be the headquarters of all information respecting drugs, have no place where the material necessary for their work can be grown, but have to depend upon the assistance—always, be it said, most willingly

given—of the Director of Kew Gardens and of the Curator of the Chelsea Physic Garden. The financial position of the Society, as shown by its balance sheet, is sound. Is it not obvious that the small expenditure necessary for extra facilities in this direction would not only further the Society's scientific work, but would also raise its position in the eyes of every learned society and educational body in the kingdom? Such expenditures would be perfectly legitimate and in harmony with the objects for which the Society was founded and with the policy pursued during the greater part of its life.

The Field for Investigation.

As further subjects on which investigation is required, I may mention the part played by alkaloids in the metabolism of the plant. At present the opinion is gaining ground that alkaloids form a means by which plants dispose of the excess nitrogen resulting from the breaking down of complex nitrogenous substances. Until more light is thrown on this it is difficult to see how rational experiments can be conducted to induce or compel the plant to produce larger quantities of such alkaloids. While the synthetic production of quinine, for example, would undoubtedly be a triumph for organic chemistry, the more economical method of production may well lie in the proper utilization of the countless millions of natural laboratories that every plant possesses in the cells of which its tissues are composed.

So vast in extent and so widely distributed are the British Dominions that they must contain an untold wealth of plants, some of which may well be superior for medicinal, dietetic, or technical purposes to those now generally employed. The Committee of Scientific and Industrial Research, well aware of this, has appointed a Forestry Research Board, of which Sir David Prain is the Director, and the Board has appointed a sub-committee which is charged with investigations of this nature, and which a pharmacognosist has been invited to assist by his expert knowledge of medicinal plants.

Many drugs reach the Society's research laboratories and museum of which the botanical sources are quite unknown. A means of determining these, or arriving at some approximation to them, based on the anatomical or other characters, would be extremely useful; here there is unlimited opportunity for useful investigation and tabulation.

That this country is, in one respect at least, in a peculiarly for-

tunate position was recognized many years ago by Jonathan Pereira, who, when appealing to the Council of the Society to appoint a Scientific Committee for the Promotion of Pharmacological Knowledge, said, with reference to the problems in materia that still remain to be solved, that:

"No country in the world possesses so many facilities for carrying on inquiries such as those to which I here allude as Great Britain. Her numerous and important colonies in all parts of the world, and her extensive commercial relations, particularly fit her for taking the lead in investigations of this kind. Moreover, she is peculiarly interested in such inquiries. From her extensive possessions in different parts of the world we draw a very large portion of the substances now used in medicine. By the establishment of a Committee on Pharmacology in the mother country an opportunity would be obtained of bringing into notice the various medicinal substances produced in the different portions of this great Empire. In this way substances now unknown to us or little employed by us might be brought into use, and in some instances, perhaps, the produce of our own colonies might be advantageously substituted for that of other countries. Furthermore, in those cases in which British products are inferior to those of other countries, this committee might be able to ascertain the causes of the inferiority and suggest the means of removing them. In these and other ways, then, I apprehend that such a committee would prove useful in a commercial as well as a scientific point of view."

University Degrees for Pharmacists.

The University of Manchester, in 1904, included Pharmaceutics in the list of subjects which may be presented for a degree in Science. Pharmaceutical students who wish to take this degree must have passed the Matriculation examination or its equivalent. They then attend courses in Chemistry, Physics, Botany, and Pharmacy, and present themselves for the Intermediate examination in the first three subjects at the end of the first year. During the second year they attend courses in Advanced Chemistry, Advanced Botany, and Pharmaceutics; during the third year further approved courses in Chemistry *or* Botany, and in Advanced Pharmaceutics; they also have to attend an approved course in an Arts subject, preferably French or German. The subjects they present for the Final are (1) either Chemistry, and (2) Pharmaceutics. Pharmaceutics include (1) General Materia Medica, Chemical, Vegetable and Animal; (2) Pharmacy and Pharmacy Law; (3) one of the following groups of drugs

treated more fully, *viz.*, (*a*) Synthetic Remedies; (*b*) Alkaloids and Glucosides; (c) Volatile Oils and Resins; (4) Laboratory Work, including Pharmaceutical Chemistry, Pharmacognosy, and Practical Pharmacy. This includes the chemical, general, and microscopical examination of drugs, their commercial varieties, substitutions, and adulterations, including assaying, the isolation of active principles, and exercises in pharmacopœial preparations.

In the University of Glasgow the candidate for the degree of B. Sc. in Pharmacy must follow a course analogous to that prescribed by the University of Manchester. It will be unnecessary for me to enter into detail beyond pointing out that the chief difficulty lies in the subjects required for the Final examination. These are Chemistry, Botany, Materia and Pharmacy.

Three years ago Miss Buchanan, at a meeting of the Council of the Society, moved: "That it be referred to the Library, Museum, School, and House Committee to approach the appropriate authorities with a view to the establishment of a degree in Pharmacy of the University of London," and earnestly commended to the attention of the Committee the desirability of giving special thought to the proposal for the erection of a College of Pharmacy which would be recognized by the University. This resolution was adopted, and the time is now opportune for making a determined effort to induce the University of London to follow the example of Manchester and Glasgow and offer facilities and inducement for our students to proceed through the degree of Bachelor of Science to that of Doctor of Philosophy, and possibly of Doctor of Science. There is no doubt that advantage would be taken of such facilities. More of the entrants into pharmacy would matriculate at the University; more of them would take a degree in Science, and some, certainly those who aspired to teach pharmacognosy, would proceed to the degree of Doctor of Philosophy.

The immediate objects that the great men who founded the Pharmaceutical Society had in view are known by heart to every pharmacist. The energy they put into their work was such that within thirteen months of the foundation of the Society the School of Pharmacy was established, and within three years the first public chemical laboratory in this country was opened. Is not this a record of which any Society might be proud? And what was the effect of this policy on the estimation in which the Society was held? The Committee for the Promotion of Pharmacological Knowledge to which

I have alluded consisted of fourteen members of Council, together with fourteen honorary members and other scientific men, of whom no fewer than eleven were Fellows of the Royal Society. Does not this fact speak for itself? And if you wish confirmation of the character of the leaders of the Society, read the Journal published by the Society while still in its infancy, and by the solidity of the information and the dignity of the style judge of the calibre of the men under whose guidance it was published. Yet their good work was checked by the rank and file, who, by insisting on a reduction of the subscription from £2 2s. to £1 1s., and so refusing to contribute three farthings a day, cut down the supplies of a Society that had to form and maintain a library and museum and support a school! What would not the position of the Society be today had it not been for that short-sighted policy?

The Renaissance of Pharmacy.

For many years the Council continued its endeavors to raise the Society to the rank of a learned body, and so acquire the influence that it should be in a position to exercise, but of recent years this policy has receded into the background. There is, however, at the moment distinct evidence of the determination of the Society to foster its scientific work more in the future than it has done in the immediate past, and I regard this as one of the most hopeful signs for the future of pharmacy. By developing the work that is our own—that is, the natural history and chemistry of drugs, either through botany and pharmacognosy on the one hand, or through chemistry and pharmaceutical chemistry on the other—we shall establish our position as a learned Society. The way is through the schools of pharmacy and through the research laboratories, which are a necessary, and should be a compulsory, complement of every school of pharmacy; teachers who have been properly trained and who are imbued with the proper spirit may be trusted to follow it.

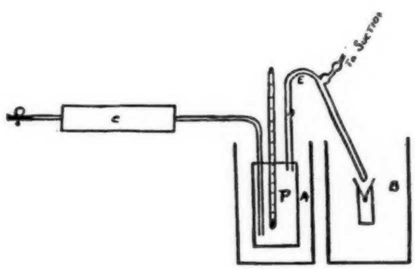
I am convinced that the future progress of pharmacy as an honored art and profession depends upon the development of pharmacognosy and pharmaceutical chemistry and specialized sciences. I have devoted my remarks to pharmacognosy, and I trust I have clearly outlined the main principle underlying them and justified its soundness. There may be obstacles to be surmounted, misunderstandings to be dispelled, and prejudices to be overcome, but the spirit of the pioneers of scientific pharmacy exists today in the great

pharmaceutical community of this country. Though latent, it is strong, and awaits only time and circumstance to become again the animating factor in the counsels of our craft. May the Pharmaceutical Society, mindful of its splendid traditions, apply its energies in the sphere that is its own, set its educational policy steadfastly in the direction indicated by the wisdom of its founders, relight the lamp of enthusiasm, and foster the love of the calling which distinguished its early years. So alone can pharmacy ensure for itself the appreciation of a nation.

DETERMINATION OF SOLUBILITY.*

By G. W. Walker.

The author had occasion to determine the solubilities of various solids in water at different temperatures. The usual method of forming a saturated solution then filtering off a portion was found to be unsatisfactory on account of loss of temperature during manipulation. The difficulty is obviated by use of the apparatus as in sketch.



The beaker A contains water or other suitable liquid in which the flask containing the solid and solvent is held. B is an air-bath containing the filter and weighing bottle. C is a combustion tube containing potassium hydroxide to eliminate CO_2 from the air.

Hot air is drawn through the apparatus, and serves to keep the solid in agitation. When the requisite temperature has been reached, the leading tube E is inserted into the saturated solution and suction gently applied. Some of the contents of F are then filtered off and at the required temperature. Of course the air-bath is kept at the necessary temperature.

Careful manipulation will give satisfactory results over a range of temperatures.

*Reprinted from *The Chemical News,* May, 1922.

THE ANESTHETIC PROPERTIES OF PURE ETHER.*†

By Raymond L. Stehle, M. A., Ph. D., and Wesley Bourne, M. D., C. M., Montreal.

At least twice within the last few years it has been reported that pure ethyl ether is not an anesthetic, and that the physiologic action ordinarily attributed to this compound is due to impurities contained in the commercial material. According to Cotton,[1] carbon dioxide may be the active agent in some ethers; but this investigator reported that he had obtained the best results by the use of ether containing ethylene and possibly another gas of unrecognized nature. According to Wallis and Hewer,[2] ketones are the most important impurities, though they state that the anesthetic action of ether is enhanced by treating it with carbon dioxid and ethylene. The lack of chemical details in the papers of Cotton and of Wallis and Hewer is unsatisfactory.

The foregoing statements appeared to warrant further investigation. All commercial ether today is manufactured by the Williamson sulphuric acid-alcohol process. The reaction is such that side reactions may occur, the products of which may contaminate the main product and therefore lend some degree of plausibility to the claims mentioned. A different method of preparing ether, therefore, was adopted. Instead of the sulphuric acid process, a general reaction well known to organic chemists was employed. It consisted in bringing sodium ethylate and ethyl iodid together in alcoholic solution, whereupon the following reaction occurs:

$$C_2H_5ONa + C_2H_5I = C_2H_5OC_2H_5 + NaI$$

The sodium iodid precipitates and the ether is separated from the alcohol by fractional distillation. The possibility of side reactions occurring is not obvious, and the product may be assumed to be quite pure. *A priori,* the possibility of contamination with aldehyds and ketones is practically eliminated because, in preparing the sodium

*From the Laboratory of Pharmacology, McGill University. The expenses of this investigation were borne in part by the James Cooper Endowment.

†Reprinted from *Jour. Amer. Med. Asso.,* 1922, 79:5:375.

[1] Cotton, J. H.: *Canadian M. A. J., 7*:769 (Sept.), 1917.

[2] Wallis, R. L. M., and Hewer, C. L.: *Lancet, 1*:1173 (June 4), 1921.

ethylate, the hydrogen generated when the metal was dissolved in the alcohol would have reduced any aldehyds and ketones present to alcohols. In order to serve as a check, however, the ether obtained was analyzed quantitatively for ethylene, while qualitative tests for aldehyds and ketones were performed.

For the ethylene test, 2 cc. of the ether in question was dissolved in tetrachlormethane, and 10 cc. of an approximately third-normal bromin solution was added. The mixture, in a stoppered bottle, was placed in the dark for eighteen hours to give opportunity for any ethylene present to absorb bromin. At the end of the reaction, the residual bromin was determined by titrating the mixture with a standard thiosulphate solution. Assuming that all of the bromin not recovered was taken up by ethylene, the maximum amount which could have been present in the ether was 0.04 per cent. It is likely that the amount was smaller than this, since some or all of the bromin may not have been taken up by ethylene, but may have substituted for hydrogen in the ether. Schiff's test for aldehyds (restoration of red color to fuchsin solution decolorized with sulphur dioxid) was negative, as was the nitroprussid test for acetone and for methyl ketones in general. Other ketones than the methyl ketones do not give the nitroprussid reaction, but all of them are excluded because of their high boiling points (the simplest, diethyl ketone, boils at 103 C). They would have been eliminated in the fractionation process.

A small amount of ethyl iodid was present in the ether. This was evident after exposing the product to bright sunlight for a few days, which cause it to take on a light amber color because of the liberation of iodin.

Being satisfied that the ether prepared was suitable to decide the question at issue, we subjected its anesthetic properties to experiment. An albino rat was the first object on which its action was tried. When placed in a jar together with 1 cc. of the ether, the animal became anesthetized almost immediately, and on removal from the jar recovered quite as fast as it had succumbed. The remainder of the small quantity which was obtained in the preliminary trying out of the method of preparation was administered to a female patient weighing 245 pounds (111 kg.) and being operated on for a large ventral hernia. Induction took place in four minutes, that is, anesthesia was brought to the first stratum of the third stage. This

depth was maintained there ten minutes when, as we had no more of the material, a change was made to one of the commercial ethers.

A larger quantity of the ether was then prepared (about 1½ pounds), and this was used in five additional cases which were chosen miscellaneously. In none of them was there any preliminary alkaloidal medication, such as the administration of morphin and atropin. The McGill modification of the Ferguson mask was used. All five patients expressed comfort during the induction period, which lasted from four to six minutes, and which was marked (except for a quite negligible amount of vomiting of food in Case 4 just before the start of the operation) by the absence of any signs of irritation, such as lacrimation, salivation, mucous formation, holding of the breath, coughing or struggling. The whole period of anesthesia was uneventful in each instance and entirely satisfactory to the surgeon conducting the operation. Recovery was immediate or early, and nausea and vomiting were minimal, even though gastric lavage was done only in the case of Patient 4. Worthy of mention is Case 6, in which good analgesia was obtained intermittently for each pain over a period of forty minutes of normal labor.

Conclusions.

Pure ether, made by a clean-cut chemical reaction which excludes almost completely any contamination with substances which have been claimed to be the real anesthetic agents of ordinary ether, possesses to the highest degree the anesthetic properties which have usually been attributed to it.

VITAMIN THEORIES.*

The essential experimental facts about the functions of the best known vitamins have become sufficiently familiar to justify the belief that these newly recognized food factors furnish something of importance in a human diet. Holt [1] recently summarized the service which the newer knowledge has rendered by pointing out how it

*Reprinted from *Jour. Amer. Med. Asso.*, 1922, 79:5:*381*.

[1] Holt, L. E.: "The Practical Application of the Results of Vitamin Studies." *J. A. M. A.*, *79*:129 (July 8), 1922.

has helped to place the whole subject of nutrition on a better scientific basis. The experimental has been substituted for the empiric method in determining the value of the different foods. Formerly we might know that certain foods were desirable and necessary; now we are often able to say why such is the case and to determine their precise value in nutrition.

The study of vitamins has helped to make clearer why a variety of foods is so essential to well being, and how danger may follow when diet becomes restricted from either necessity or caprice. Decrying the indiscriminate use of alleged vitamin-bearing preparations as popular therapeutic agents, Holt further utters the warning that until they have been confirmed by adequate clinical experience there is some danger in relying too much on the results of laboratory observations on animals of a different species whose physiologic needs may be different from those of human beings. In a somewhat similar strain, Mitchell [2] has asserted that in the total lack of quantitative data on the vitamin requirement of man, and in the general absence of malnutrition or disease among people in this country which can with any degree of probability be diagnosed as involving vitamin deficencies, it seems premature to formulate recommendations for the balancing of diets with respect to vitamins. It is pointed out that the classic experiments are conducted in each instance on species peculiarly susceptible to the particular deficiency under investigation. However, this sort of criticism is a conventional one in medicine. While admitting the background of truth in it, we must recall that the clues furnished by animal experimentation have led to so many helpful avenues of information that it would be scientific folly to fail to heed them, even in our as yet inadequate understanding of the possible bearing of vitamins on human welfare. There is no necessary conflict between an open mind and conservatism in scientific judgment. Hence we are glad to reiterate the warning of Mitchell, when he writes:

"At a time when popular periodicals are widely publishing irresponsible articles on vitamins, ignorantly or deliberately creating an entirely distorted popular conception of them, and when commercial concerns are widely advertising purely hypothetical advantages of

[2] Mitchell, H. H.: "The Necessity of Balancing Dietaries with Respect to Vitamines." *Science, 56*:34 (July 14), 1922.

vitamin preparations, it is particularly important that investigators in nutrition exert great care in the wording of statements as to the practical significance of vitamins in every day life. Otherwise they may become unwilling accomplices in the perpetration of a gigantic fraud upon the American public."

It is in harmony with such conservatism of statement, we believe, that the recent report of the Council on Pharmacy and Chemistry of the American Medical Association on yeast preparations has been formulated.[3]

With so much uncertainty still admitted it might seem futile to discuss at this time the theories of the mode of action of vitamins. However, the history of science attests that its development has more often been promoted rather than retarded by the leavening influence of hypotheses. Most investigators of the vitamins have looked on them as functioning somewhat as hormones are supposed to act in the organism, namely, as stimulants to certain physiologic mechanisms. Others have imagined the newly discovered factors to be essential components of some, at least, of the living tissues; thus they would be quite as indispensable as are other structural units of the body, such as certain amino-acid groups, calcium, phosporus or iron. A further group of students has assumed the vitamins to be primarily catalytic in function, thus behaving like the well known enzymes. Hess,[4] of Zurich, has lately offered somewhat indirect evidence that the antineuritic vitamin, which relieves the symptoms of poly-neuritis in animals fed on diets devoid of vitamin B, contributes in some way to the production of oxidative enzymes in the body. Studies in vitro on the tissues of polyneuritic pigeons indicated to him a decrease in the oxidative enzymes usually found in well nourished animals. On this hypothesis the avitaminosis is an expression of poverty of the cells in the factors that facilitate tissue respiration. This is one of the many guesses which the future will need to evaluate in the physiology of vitamins.

[3] Yeast Preparations, New and Nonofficial Remedies. *J. A. M. A., 79*:135 (July 8) 1922.

[4] Hess, W. R.: Die Rolle der Vitamine im Zellchemismus. *Ztschr. f. physiol. Chem. 107*: 284 (Dec. 21) 1921.

SCIENTIFIC AND TECHNICAL ABSTRACTS

SIMPLE TEST FOR SUGAR.—A simple test for the detection of sugar in urine is given by J. Livingston (*B. M. J.*, May 6, 1922, p. 719), who points out that a drop of urine containing sugar evaporated on a microscope slide over the flame of a spirit lamp leaves a "tacky" glistening film of syrup. Further heating turns this film a rich golden color. Full heating converts the deposit into burnt sugar or caramel. Urine containing 14 grains to the ounce, according to fermentation test, gave the reaction after dilution with five times its volume of water.

TREATMENT OF POISON OAK DERMATITIS.—The author uses an alcoholic solution of the toxin of the poison oak plant (*Rhus diversilobia*) for this purpose. A given weight of the fresh crushed leaves of the plant is covered with absolute alcohol, extracted, filtered, and precipitated, and the precipitate dried at a low temperature. A given weight of the toxin is dissolved in absolute alcohol and sterilized water added. An arbitrary standard is set for the weight of the toxin, volume of absolute alcohol, and the volume of sterile water. Of the several hundred patients injected, only a few have felt faint or nauseated, but this was shown to be due chiefly to psychological factors. Though not invariably successful, the results obtained are superior to those seen after any other form of treatment. From 0.5 to 1.5 cc. is given intragluteally, and the dose is repeated in twenty-four hours, and again twenty-four hours later if improvement is not very definite. Usually within forty-eight hours there is great improvement, and it is seldom that a third injection is found necessary. At the same time, the following solution is given by mouth until finished:—Oak toxin solution, 4 gms.; aromatic elixir, 90 cc. The dose is 10 drops in water thrice daily, increasng by one drop each dose until 20 drops are being taken. Then one teaspoonful is given once daily. By this method tolerance for the poison may be established, and it is recommended that this solution be taken once a year.—(H. E. Alderson, through *Journ. Amer. Med. Assoc.*, June 17, 1922.)

Fish-liver Oils as Sources of Vitamin A—The exceptionally high content of vitamin A in some liver oils has already been pointed out, and the authors have drawn attention to the fact that this high potency was not only characteristic of cod-liver oil, but that it was also shared by oils from the livers of other fishes, such as the coal-fish and the haddock. They find a very marked variation in the vitamin potency of different liver oils, and they point out that although this variation in potency may be sixteen-fold, the least potent oil they have examined has proved to be more active than any other substance containing vitamin A, and this very high vitamin content is found to be characteristic of fish-liver oils in general. The method of preparation is not responsible for the variation, and it is therefore concluded that some physiological cause, such as variation in the food or in the sexual condition of the fish may influence the potency of the oil. They draw attention to an important fact, namely, the very high potency of the soft and hard roe of the cod, which are a rich source for vitamin A, and they maintain that in the roe we have a very palatable article of food very rich in the vitamin, and it should therefore be valued for this quality. Besides the liver oils mentioned, they find very great activity, also, in the liver oils of the ling, skate, shark, plaice, and pollock, so that the high vitamin content is not confined to the liver oils of the gadoids. The potency of these oils is of the same order as that of cod-liver oil, and of the liver oils so far examined the highest activity is found in coal-fish liver oil and the lowest in haddock liver oil. The high vitamin A content is not only characteristic of Norwegian oils. Specially prepared oils of British origin are of a similarly high potency. Several samples of Newfoundland cod-liver oils were found to be as potent as the most active Norwegian oils.—(S. S. Zilva, D. Sc., and J. C. Drummond, D. Sc., *Lancet,* June 24, 1922, 1243.) Through the *Pharm. Journ. and Pharm.*

Determination of Caffeine in Tea.—A study of the methods of determining caffeine in tea has been conducted by the Association of Official Agricultural Chemists, including also a modified method which is much shorter than those heretofore in vogue. The results are set forth in some detail in the twenty-sixth annual report of the Connecticut Agricultural Experiment Station. The modified procedure, which is found to give good results, is as follows:

To 5 grams of the finely powdered material in a 500 cc. flask, add 10 grams of heavy magnesium oxide and 200 cc. of water, and boil gently over a low flame for two hours, using a small-bore glass tube about 80 cm. long as a condenser. Cool, dilute to 500 cc. and pass through a dry filter. Take 300 cc. of the filtrate, equivalent to 3 grams of the material, introduce into an Erlenmeyer flask, add 10 cc. of a 10 per cent. dilute sulphuric acid and boil until the volume is reduced to about 100 cc. Filter into a separatory funnel, washing the flask with small portions of 1 per cent. sulphuric acid, and shake out six times with chloroform, using successively portions of 25, 20, 15, 10, 10, 10 cc. each. Add to the combined extracts 5 cc. of 1 per cent. potassium hydroxide. When the liquids have completely separated, draw off the chloroform layer into a suitable vessel, wash the alkaline solution with two portions of 10 cc. each of chloroform, add these washings to the main bulk, transfer to a tared flask, evaporate to dryness, finishing by drying in the water over at 100° C. to constant weight. If desired, the residue may be treated by the Kjeldahl method to determine nitrogen, calculating the caffeine by the factor 3.464. The heavy magnesium oxide should meet U. S. P. requirements.

The results calculated from nitrogen determinations have not been wholly satisfactory.

H. L.

MEDICAL AND PHARMACEUTICAL NOTES

DRUG ADULTERATION IN CONNECTICUT.—The twenty-sixth annual report of the Connecticut Agricultural Station, recently issued, covering the work for the year 1921, gives many data in regard to both standard and proprietary preparations.

A sample of an elixir sold for general laxative and anthelmintic uses contained nearly 8 per cent. of alcohol, with spigelia, emodin-bearing drugs and aloes. A non-advertised preparation offered as a cure for tuberculosis and claimed by a user to have actually made a cure, was found to be a syrup containing alcohol, chloroform and vegetable extractives. Twenty-four samples of Bay Rum were tested. Many were short in alcohol, but no methanol was detected. Most

of the official preparations tested were found to be correct. Eighteen samples of chlorinated lime were tested; all were under strength, some very deficient. Much of this defect, however, may be due to decomposition after packing. Witch-hazel water samples did not contain any methanol.

A sample, claimed to be pure Spanish olive oil, was submitted to the department by the H. J. Heinz Co., because it responded to the tests for sesame oil as usually applied. This was confirmed when the Baudouin and Villavecchia tests were used on the oil, but when applied to the liquid fatty acids no appreciable reactions were observed. This shows the necessity of checking tests on the oil by tests on the liquid acids. In this connection it may be noted that heated or hydrogenated cottonseed oil does not respond to Halphen's test.

Many examinations were made of diabetic, special and miscellaneous foods. As might be expected, samples were found that claimed to be starchless but were not so. One sample so labelled was found to contain about 70 per cent. of available carbohydrate, most of which was cassava starch. Another sample recommended especially for diabetic patients contained about 50 per cent. of starch and soluble reducing sugars.

Kaffee Hag was tested and found to contain 0.09 per cent. of caffeine. Of four samples of cider, three contained respectively 5.75 per cent, 5.93 per cent. and 4.16 per cent. of alcohol. The other sample contained only a trace, and no preservative was detected.

H. L.

THE OLDEST TREE IN THE AMERICAS.—Mexico's largest tree, the venerable cypress in the churchyard at Tule, which foresters say was standing 1,000 years before Columbus discovered America, is beginning to show the weight of years.

The giant tree is a *Taxodium distichum* and its Aztec name is "ahuehuetl." It was so well grown 400 years ago that it sheltered under its generous spread of branches Hernando Cortez and his followers on their ill-fated expedition to Honduras, and was at that time a source of astonishment to those hardy and hardened conquistadores.

Today it is about 160 feet high and four feet from the ground its trunk is 160 feet in circumference. Its branches have a spread of 140 feet.

Recently the great trunk has shown signs of splitting. Reports from the State of Oaxaca, to which many tourists have gone in years past for a sight of the "great tree of Tule," are that age is at last putting its mark on this representative of the forest family commercial lumber interests have exploited as "the wood eternal."

In size is resembles the great Banyan (*Ficus Indica*) in the botanical garden at Calcutta and the Chestnut Tree of One Hundred Horses, said to be the largest tree in the world, at the foot of Mt. Etna.

Baron von Humboldt was so impressed by the gigantic proportions of this great savin, which he considered a worthy rival of the huge baobab (*Adansonia digitata*) of Africa, believed to be the oldest organic monument on the globe, that he inscribed his name on the trunk, an inscription now nearly overgrown by the bark.

De Calvino, E. M.—"Los Pelos Urentes de la Pica Pica" ("The Stinging Hairs of Mucuna Pruriens"), Revista Medica Cubana 33: 1-16, 6 fig., 1922.—Author first describes the aerial portion of *Mucuna pruriens* as found in Cuba, Porto Rico and the other Antilles. The microscopical characteristics and constituents of the stinging hairs are then taken up, after which a comparison is made between the hairs of *Stizolobium capitatum* (Velvet Bean), and *Mucuna pruriens.* The article concludes with the therapeutic properties, constituents of the seeds and treatment of the itch produced by the hairs. Author states that the hairs of the fruit of *Stizolobium capitatum* differ from those of *Mucuna pruriens* by the absence of hooks and mineral incrustations in the cuticular membrane.

H. W. Y.

NEWS ITEMS AND PERSONAL NOTES

Professor Bougault Succeeds Professor Emile Bouquelot.—Professor Bougault, who was recently elected an honorary member of the Philadelphia College of Pharmacy and Science, has occupied the chair of Galenical Pharmacy at the Paris Faculty of Pharmacy since it was left vacant last year by the death of Bourque-

lot. As a matter of fact, he is the pupil of Bourquelot as well as his successor. When young Bougault passed his qualifying examination as "interne" (hospital house pharmacist) in 1893 he was allotted to the Laennec Hospital—the old building near the "Bon Marché" familiar to all lady shoppers in Paris—where Bourquelot was so long head pharmacist. The old laboratory there has produced some well-known scientists, and the "interne" found himself in such congenial surroundings that when he took his diploma he decided not to start in business, but to continue his researches. He became a preparator at the Paris Superior School of Pharmacy (as the faculty was then termed), worked under Professor Villiers, and finally, in 1909, became an assistant professor. Meanwhile he had successfully passed the examinations qualifying him for the post of head-pharmacist in a Parisian hospital and held that position first at the Hospital Herold, subsequently at Trousseau, and finally at the Tenon Hospital. His scientific researches have principally been in organic chemistry, and for these he was awarded the Gobley prize in 1901, the Jecker prize of the French Academy of Sciences in 1910, and the Berthelot medal in the same year. He was elected a member of the Paris Society of Pharmacy in 1903, and was chosen as its president in 1921. He belongs to the editorial staff of the *Journal de Pharmacie et de Chemie,* and reviewed in this periodical the United States Pharmacopœia in 1906 and the British Pharmacopœia in 1898.

Dr. Whelpley Resigns as Secretary of the Missouri Pharmaceutical Association.—Dr. Henry M. Whelpley, after thirty consecutive years of service as permanent secretary of the Missouri Pharmaceutical Association, insisted on the organization finding a successor. Professor D. V. Whitney, of Kansas City, finally consented to take up the work for the ensuing year.

A Sept-Centennial.—The Philadelphia College of Pharmacy and Science has just celebrated its hundredth anniversary and Philadelphia City is preparing to celebrate the hundred and fiftieth anniversary of the founding of our nation. Both celebrants feel somewhat old, but they are infants in comparison with the University of Padua, which last May celebrated its seventh centennial. Many rep-

resentatives were present from various countries, institutions and societies. Memorial volumes were issued and the usual programs carried out.

A. Homer Smith, Secretary Drug Manufacturers' Association.—A. Homer Smith, is the new secretary of the American Drug Manufacturers' Association. He has spent practically his entire commercial life in the drug business. Beginning as a clerk in a retail drug store, he served ten years behind the counter, meanwhile attending the Philadelphia College of Pharmacy and Science, by which he was graduated in 1902 with the degree of Doctor in Pharmacy.

Mr. Smith joined the sales force of H. K. Mulford Co., Philadelphia, about 1905. He remained with that firm fifteen years, becoming, in turn, special representative, assistant sales manager, general sales manager and secretary of the company. In 1920 he became associated with the Nyal Co., Detroit, as a director and general manager. The pharmaceutical side of the industry called him thence after a short time and he joined the organization of E. R. Squibb & Sons, this city, as secretary. During the war Mr. Smith represented the drug trade on the War Service Board at Washington, and he has been a prominent figure in the deliberations of the industry in connection with national questions, legislative and otherwise.

Received by President Harding.—On Friday, June 30, 1922, President Harding received in the White House the Medico and Pharmico Club of Cleveland, Ohio. The delegation was one of the largest that has visited the White House, numbering 120 prominent physicians and pharmacists of Cleveland, as well as members of the graduating class of Western Reserve University College of Pharmacy.

They had travelled in large, sight-seeing auto busses, having left Cleveland via the Lincoln Highway across the Allegheny Mountains, to Gettysburg, where they went over the famous battlefields of Civil War days.

Thence they proceeded to Philadelphia, where their principal objective was a visit to the Pharmaceutical and Biological Laboratories of H. K. Mulford Company. They also viewed the botanical gar-

dens which are being conducted by the H. K. Mulford Company in collaboration with the Philadelphia College of Pharmacy.

From Philadelphia the party proceeded to Baltimore and Washington, where the reception by their fellow Ohioan, President Harding, took place. Following the Presidential reception, there was a special luncheon, where a number of prominent speakers were heard, including Samuel L. Hilton, President of the American Pharmaceutical Association, W. H. Bradbury, Manager of the Washington Wholesale Drug Exchange, and others.

BOOK REVIEWS

AN INTRODUCTION TO THE PHYSICS AND CHEMISTRY OF COLLOIDS. By Emil Hatschek. 4th Edition. 165 pages with 20 illustrations. Price, $2.25. P. Blakiston's Son and Company, Philadelphia.

This is an enlarged and rewritten edition of a book that was originally intended to introduce colloidal chemistry to readers possessed with a reasonable knowledge of physics and chemistry. The twenty-five chapters take up the history of the subject, its development in recent times, the nomenclature, classification of the various phases of the subject, methods of forming colloids and of coagulating them, the theories underlying phenomena of colloids, and a few practical applications. The subject matter is presented in readable style and printed with good type on fair paper. There is much more real meat in the book than the number of pages would lead one to suspect. The size of the volume is such as to make its owner to easily slip it into a coal pocket to be ready for use when he finds a few moments available for reading. As an introduction to colloid chemistry it very satisfactorily fulfills its mission.

F. P. STROUP.

IMPURITIES AND FALSIFICATIONS OF CHEMICALS, THEIR DETERMINATION AND RECOGNITION. By Dr. R. Strauss, Chemiker. 96 pages. M. Bohlmann Verlag Meissen (Germany).

According to the preface, "this book is mainly written for the manufacturer, trader and consumer in the chemical branch, to acquaint him with the nature of the chemicals passing his hand, to show

how the qualities, falsifications and impurities can be recognized." It is intended to give the non-chemist easy practical methods, with no hint of theoretical argument. Even chemical formulas are omitted.

The book is, doubtless, an attempt to translate a German work into English, the translating being done by one whose knowledge of English was decidedly limited. All through the volume there is evidence that the translator had recourse to an English-German dictionary, the result being that the book is full of ludicrous expressions, as well as mis-translations. Here are a few examples:

On page 4 we read in a description of the manufacture of sulphuric acid, "The right raw-product is the sulphur and its combinations with the heavy metals, the silicates, zinc ores and brilliants, mostly iron silica or pyrite, zinc ore, potters ore and copper silica." On page 36, under tests for impurities in soda we read: "Iron: The solution made sour and potash ferrocyanide produces a blue colouring, if iron is present a green colouring." Again, "Natron Sulphite: When made sour with muriatic acid a strong smell of sulphuric acid appears (if heated)."

Most of the important commercially inorganic chemicals and a few organic compounds are mentioned. The intention of the author was good, but the results, at least as far as the English version is concerned, are anything but satisfactory. The chemist who is familiar with the facts recorded (or purporting to be recorded) on its pages finds difficulty in grasping the meaning of many of the paragraphs, even though he is not unfamiliar with German. What, then, would be the value of the volume to the man for whom it was written, the non-chemist? It is just as well that no price was quoted.

F. P. STROUP.

The firm of Theodor Steinkopff, Dresdin-Blasewitz, the publishers of the world-wide-known Pharmazeutische Zentralhalle, founded in 1859 by that master of pharmacy, Dr. Hermann Hager, have begun the publication of a *Natural Science Series,* edited by Dr. Raphael Ed. Liesegang, of Frankfurt, A. M. The following two volumes have been received for review:

ANALYTISCHE CHEMIE. Von Dr. Th. Döring, o. Professor an der Berkademie Freiberg. 8vo., pp. 97. Price 44 cents.

The five parts of the book are arranged as follows: I General;

II, Detection, Quantitative Analysis and Separation of the Cations; III, Detection, Quantitative Analysis and Separation of the Anions; IV, Determination of C, O and gases in metals, especially in iron; V, Elementary Analysis of organic substances. An excellent authors' and subject index conclude the work, which is up-to-date in every respect and which we can highly recommend.

ORGANISCHE CHEMIE. Von Dr. R. Plummerer, Prof. Univ. München. 8vo., pp. 182. Price 96 cents.

The text before us is a condensed, but up-to-date organic chemistry. Dr. Plummerer, an authority on this subject, has arranged the book in an excellent manner in eighteen chapters, from which we will cite the following few: 3, Thermo and Spectro-chemistry and Absorption Spectra; 5, Oxonium Salts; 10, Tritumediates and Colors; 11, Methods of Oxidation and Hydration; 13, Sugar (monoses, bioses, polyoses, glycerin fermentation, amino-sugar and glucosides); 15, Tannins; 16, Enzymes and Hormones; 17, Alkaloids; 17, Hæmoglobin, Chlorophyll and Assimilation of CO_2.

This excellent work should also become better known on this side of the "great pond"!

OTTO RAUBENHEIMER, Ph. M.

DER GRAF CAGLIOSTRO. Die Geschichte eines Mysterienschwindlers zur Warnung für unsere Zeit. (Story of a Charlatan and Fraud as a Warning in Our Time.) Von Heinrich Conrad. 12 mo., pp. 270. Robert Lutz, Stuttgart.

That Count Allessandro Cagliostro, the celebrated alchemist, charlatan, adventurer and fraud, gained the rudiments of his chemical knowledge in an apothecary shop is perhaps not well known. Giuseppe Balsamo, his true name, was born August 8, 1743, in Palermo as the son of poor parents. He entered the order of the Brothers of Mercy and was employed in the pharmacy at the monastery in Palermo. He joined the Greek alchemist, Althotas, thereby gaining further chemical knowledge, and traveled extensively. Cagliostro, the wanderer and adventurer, became the king of all alchemists and fraud of his time, due to the ready credulity of the public,

which had been prepared by such men as Emanuel Swedenborg, the Swedish minister and spiritualist, Franz Mesmer, the Swiss founder of the doctrine of animal magnetism, Johann Joseph Gassner, the Bavarian banisher of the devil, and Count Saint Germain, who was said to have attained an age of 1700 years, due to the species or tea which still bears his name.

These pioneers or forerunners paved the way for the frauds of Cagliostro. He sold his Lotion to produce a beautiful skin, his Egyptian Wine, his Rejuvenating Powder and his Elixir of Life to "make the old young" and to produce that much desired "youthful vigor." He sold formulas for the transmutation of metals and for the preparation of the philosopher's stone and he gave free medical treatment to the sick. Cagliostro was in communication with the "other world" and held spiritual séances and besides that was a clever astrologist. He established an order which he called Egyptian Freemasonry, in which, as Grand Kaphta, he pretended to know the secrets of futurity, and made many dupes among the higher classes.

He maried Lorenza Feliciana, whose beauty, ability and want of principle made her a valuable accomplice to his frauds. Under the name of Princess Santa Croce she became the favorite and mistress of Prince Potemkin, so that the Empress Catherine II paid her and Cagliostro the sum of twenty thousand rubles to leave Russia forever. The couple traveled repeatedly throughout the different countries of Europe and found ready dupes even among the higher classes, as the kings, princes, nobility and clergy.

The book before us is highly interesting and abounds with numerous tales how the charlatan and impostor defrauded the public and how he was witty and prompt enough to avoid detection. When the celebrated Swiss preacher, poet and writer, Lavater, asked Cagliostro the following three questions:

"From where did you obtain your knowledge?
"How did you get it?
"What does it consist of?"

he gave the following laconic reply:

"In verbis.
"In herbis.
"In lapidibus."

In Strassburg, Prof. Horberg, of the University of Upsala, addressed Cagliostro, who pretended to be of Arabian origin, in Arabic, but he was unable to answer him. L'affaire du collier, in the French Court under Queen Marie Antoinette, took place in Paris in 1785, and as a result Cagliostro and Lorenza were imprisoned in the Bastille and were then exiled. Going to England he was attacked by another power, namely the press, which exposed him in such a way that he had to leave the country. On his visit to Rome the Church committed him to the Castle of San Angelo, where on March 21, 1791, he was condemned by a decree of the Pope to imprisonment for life as a freemason, an arch-heretic and a sorcerer. He died in 1795 in San Leone in the Duchy of Urbino. The beautiful Lorenza was committed to a convent.

Cagliostro has been made immortal not only by the present book, but also by the plays and works of Schiller, "Geisterseher"; Göethe, "Gross Kophta"; Dumas pére, "Mémoirs d'un Médecin," and Carlyle, "Cagliostro and the Diamond Necklace."

The book before us is well suited for the library of pharmacists who take an interest in their profession, especially in the historical side.

OTTO RAUBENHEIMER, Ph. M.